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PUBLIC WORKS

An Engineering and Construction Monthly

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CITY COUNTY STATE

PUBLIC WORKS is devoted to the design, construction, maintenance and operation of *public improvements.*

The major subjects covered are: Highways, Water Supply, Sewerage, Refuse Collection and Disposal, Street Cleaning, Bridges, etc.

Vol. 61 August, 1930 No. 8

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Coming

Articles in our files for early use range from "Water Supply in Holland" to "Two Activated Sludge Plants in Japan." In addition water works engineers can look forward to a description of the construction of the great Saluda Dam in South Carolina; to the first of a series of articles by A. E. Clark, an authority on the subject, on the treatment of difficult waters. Major Blew has contributed some valuable material on the corrosion of iron and steel due to electrolysis and other causes. There will be more about snow removal methods from a number of city and county engineers who are wrestling with this problem. Valuable data on "Road Location and Design to Prevent Drifting" is given by an engineer of the Minnesota Highway Department. Prof. Steel, from Texas, has summarized best standard practice on trade waste treatment in a handy reference form. Data furnished to us by 43 states form the basis of an article on the use of patented materials in highway construction. The conclusion of the article by Mr. Tebbs on "Efficient Operation of Concrete Paving" will appear in the September issue. Any highway engineer or contractor who does not read and study this article, the first installment of which will be found on page 34 of this issue is missing a good bet. Mr. Bender has written for us a description of the most modern sewage treatment plant in the east, where even the effluent is passed through rapid sand filters.

Military Sanitation

One hundred and fifty men, mostly sanitary engineers and among them many of the readers of this magazine, have now profited by the course in millitary sanitation which has been given for the past three years at Carlisle, Pa., by the Medical Department of the Army. The graduates of this course have formed themselves into an organization with the approval of the Surgeon-General, Major-Gen. M. W. Ireland, who is a charter member. This organization, the Order of the Boar, is attaining a standing and a power entirely out of proportion to its age or size. Among its better known members are Major F. E. Daniels of Harrisburg, Pa.; Major M. J. Blew of Philadelphia, now president; Major J. C. Diggs of Indianapolis, State Superintendent of Parks; Major Stover of the Louisville Water Works; Major F. O. Adams, Engineer of the Detroit Board of Health, and many others. The course at Carlisle just completed, was perhaps the most successful that has yet been held. The younger men engaged in sanitary engineering work by states, counties and cities, should apply for reserve commissions in the Sanitary Corps of the Army, and make application to attend this course. No better training can be obtained anywhere. Information can be obtained by writing Major W. A. Hardenbergh of this magazine.

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BUY A BUSINESS, SEE Classification 45
Seattle Post Intelligencer
THE POST-INTELLIGENCER
SEATTLE, APRIL 7, 1930.
MONDAY PART TWO
PART TWO MONDAY
HEALTH CHIEF'S REPORT ATTESTS WATER SUPPLY PURITY
CHLORINATION TREATMENT IS IMPROVED ON
"The high standard of Seattle's water from the standpoint of the public health has been maintained through chlorination, it is declared in the annual report of Dr. E. T. Hanley, city health commissioner.
"The water department recently installed measuring devices which automatically record and regulate the flow of water and the amount of chlorine added.
"This apparatus was in operation during the whole of 1929 and we are convinced that its installation was a definitely progressive step and that we are now fully justified in regarding Seattle's water as being safe.

Automatic Chlorination — Solves Seattle's Problem

"The Only Safe Water is a Sterilized Water"

ACCURATE proportioning of chlorine dosage to a widely varying flow was Seattle's problem. Dependable automatic control apparatus a necessity. « « That the six W & T Automatic Vacuum Chlorinators installed on Young's Lake Supply adequately fill this need is evidenced by Dr. Hanley's report. « « Technical publication 106 (yours for the asking) describes this apparatus in detail.

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SA-73

The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

PUBLIC WORKS
CITY COUNTY STATE
AN ENGINEERING AND CONSTRUCTION MONTHLY
Vol. 61 August, 1930 No. 8

Snow Removal from Milwaukee Streets

Snow removal and snow fighting methods and equipment as used on highways and on city streets in various states, from Massachusetts to Washington, will be described in a series of articles, some in this and some in succeeding issues. In the first, a Milwaukee official describes the methods employed in that city.

By P. M. Johanning
Mechanical Engineer, Dept. of Public Works, Milwaukee

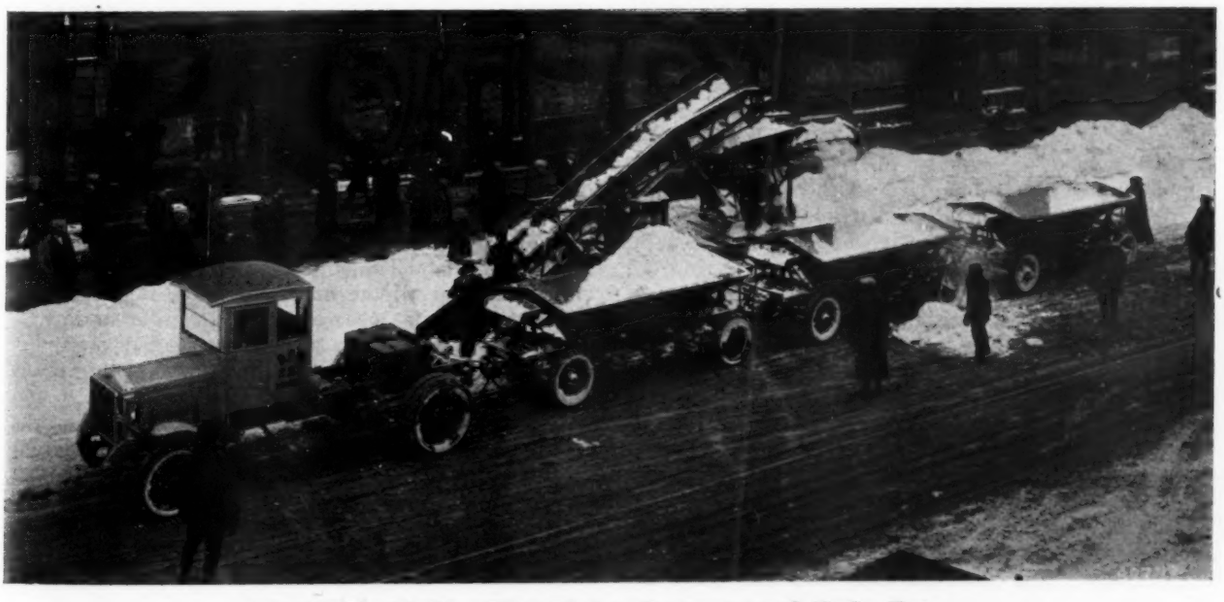
A DESCRIPTION of the method of handling heavy snow in Milwaukee is best begun by briefly outlining the organization. The Department of Public Works is divided into various bureaus, including three interested in snow removal—Street Sanitation, Municipal Equipment, and Garbage. It is naturally the duty of the superintendent of street sanitation to maintain the streets in a sanitary, passable condition. All equipment is under the supervision of the superintendent of municipal equipment, and is rented to other bureaus and in some cases, to other departments of the city. The rental charges are intended to cover actual costs of the operators and expenses, including the necessary overhead of the bureau, the repairs and maintenance and rent actually paid by the bureau for storage of equipment.

In cases of an expected snow, the Bureau of Municipal Equipment is ready to furnish equipment as called for.

The supervisor of collection in the Garbage Bureau can easily divert his complete collection equipment, with men, to the removal of snow. Since his organization is adapted to this work, and since the engineer who recommended the use of snow loaders was formerly attached to that bureau, the bulk of the snow is still removed from the down-town streets by this bureau.

Milwaukee, Wis., experienced three snow storms during the winter of 1929 and 1930. These, according to the Federal Meteorological reports, consisted of: 7.1 inches on Dec. 18th, 12.2 inches on Jan. 9th, and 7.2 inches on March 26th.

The last of these snow falls, because of the season, remained on the ground only a few days. After five days, only 1½ inches remained. The snow of December 18th was reduced to 2.8 inches in eight days. In both cases some few drifts remained where the sun had no effect on the snow, and, due to the scar-



Snow-Loading Machines Being Used in Conjunction with Trailer Trains.

city of work and an abundance of labor in need of assistance, these were removed.

The snow of January 9th started to fall in the morning, and became exceedingly heavy in the afternoon, making it difficult for many automobiles to return home from work at night.

The city has three Barber-Greene snow loaders with side conveyors, which are used to load into 4½-yard "Highway" trailers, towed by "Sterling" tractor trucks. During the past winter the three loaders were used a total of 173 hours. The cost of loading this snow with loaders was 4¼c per cu. yd. This snow is hauled to several locations, and dumped into the river. The cost of this hauling when loaded with a loader was 8½c per cu. yd. or a total of 12¾c per cubic yard, to dispose of the snow. These figures do not include interest or depreciation on any equipment, nor the repairs on the loaders.

The loaders should be crowded into the snow, and thus load automatically, but usually one man with a hoe on each side of the loader is required to assist in feeding the loader. One operator for the loader and an assistant to operate the side conveyor are all the mechanics required. There is usually one man with a shovel to clean up and load by hand any spillage or leavings. The number of trucks with trailers depends on the length of the haul, no measurable time being consumed in dumping the trailers. Each truck, with driver and trailer-man, has three or four trailers, depending on ground conditions. The above detailed crew is in charge of a man delegated by the supervisor of garbage collection.

In the three snow storms of the past season, 29 snow plows were in service December 19th, 25 on January 9th, and 15 on March 26th. These snow plows consist of a mold-board plow attached to a tractor or similar heavy truck. The bureau has 19 Gettleman, 8 Baker and 16 Champion makes of snow plows.

In addition to the above equipment, horse-drawn trailers, and dump wagons used regularly for collecting ashes, are used for removing snow. These are loaded by hand. There is no record of the amount of snow removed by this method, but the cost per yard will greatly exceed that of machine-loaded snow. The cost of moving snow in trailers is much less than in dump wagons, as a trailer usually has double the capacity of a wagon, and can be dumped sideways into the river without shoveling or additional labor.

Snow Removal in Monroe County, New York

Towns and county cooperate in work and in financing snow removal on state and county aid and some town roads. Organization, equipment and procedure.

By William J. Caward

Assistant Engineer of Highways, Monroe County, New York.

THE present system of snow removal in Monroe County, New York, is of fairly recent origin. Until the season of 1923-24 the county did not participate in the payment for snow removal. The town superintendent of each town, with what equipment he had, kept open only those main roads that were absolutely necessary to accommodate winter traffic. The cost of the equipment and the entire cost of the work of snow removal was borne by each individual town. In 1923 both the towns and the county were aroused to the fact that a considerable number of miles of good road were not open to traffic during the winter months on account of snow. The uninterrupted use of these roads was of the greatest importance both to commercial traffic and to the traveling public and it was felt that it was poor policy to build high class roads which could be used only during the snowless months. The result was the inauguration of the present county system of snow cleaning in this county.

Financing—This system was first put into successful operation during the winter season of 1923-24 and has been continued since that time with little change. For this first season the county appropriated $60 per mile, to which the town added $15. In 1924-25 this appropriation was increased to $80, with the town adding $20. Even this was found to be too small and in 1925-26 it was increased to $100 per mile and $15 respectively. The same amounts were used in 1926-27. This participation of the county in the cost of the snow removal enabled the towns to purchase more modern and efficient equipment, with the result that in 1927-28 the county was able to reduce its appropriation to $95 per mile, the towns still adding $15 per mile. In 1928-29 the amount was still further reduced to $90 per mile with $15 added by the town, and the same amounts held for 1929-30 season.

While the roads cleaned under this plan were principally State and County Aid roads, certain sections of town roads which served as connecting links between main roads were included. During the first season of 1924-25, 441 miles of road were kept free of snow. This mileage has been increased each succeeding season, until during the season of 1929-30, 700 miles of road were kept open for traffic with almost no delays.

Organization—The object of the snow cleaning system is to keep all the main highways in the county open for traffic the year around. In order to do this, the county utilizes the already perfected organizations under the town superintendents of highways of the various towns These towns have trucks and tractors which can be utilized in snow cleaning work; also the town forces are familiar with the different roads in each town and, living in different sections of the town (as is usually the case) are conveniently located to clear roads and can readily be secured for this work.

Procedure—Long before the first snow falls, comes the cutting down of weed stalks and brush on all

county roads. At first thought this may seem to have little to do with snow cleaning but it must be remembered that weeds and brush cause drifting of snow. The Good Roads Committee of the Board of Supervisors of Monroe County has recognized this fact and, in order to be sure that such work is done, the county now pays all of the cost of cutting weeds and brush on all roads built with County Aid money.

Another factor that is vitally important in successfully keeping roads free of snow is the erection of snow fence a few rods back of all cuts where snow is liable to drift, and always on the side of the road from which prevailing winds blow. The old type of cumbersome wooden board snow fence is very little used in Monroe County, it having been largely discarded and the woven wire and lath type substituted, this type having been found to be much easier to haul, handle and set up and equally as effective as the old board type if not more so. During the past season of 1929-30 59 miles of snow fence were used. The cost of erecting and removing this fence was approximately $190 per mile of fence.

The general plan of snow removal is as follows. Before any snow falls, the town superintendent of each of the nineteen towns is required to see that his equipment is in first class running order and to place this equipment in such locations as to best facilitate the clearing of the roads as rapidly and effectively as possible.

The office of the county superintendent has in the meantime prepared a separate map of each town showing just which roads are on the county system and are to be kept free of snow and furnished copies of these to the town superintendents. This enables the foreman in charge of each gang to know exactly what roads he has to take care of. He is also told what men he has available, where they are located, and the location of his equipment. Each foreman is responsible to the town superintendent for the mileage in his respective section. As soon as the snow reaches a depth of from 3 to 4 inches, with indications that the storm will continue, each foreman goes out with his gang and equipment to keep these roads in his section open.

At its best, snow removal is a hard, strenuous operation. Frequently heavy snow falls late in the day, making it necessary to keep plows and gangs working all night as well as day. Most of the snow storms are accompanied by high winds which cause heavy drifting of snow across the road, requiring a plow to go back over a road at frequent intervals until the storm has abated. Frequently it is necessary to augment the snow plows by a gang of hand shovelers, especially if the snow fall is heavy and drifting badly. Such work must be carefully organized and all possible arrangements made well in advance so that there may be no confusion or delays when the snow storms arrive. The secret of successful snow cleaning is, we believe, in starting early and keeping ahead of the storm.

Equipment—The equipment used consists chiefly of heavy trucks, usually 5-ton, with snow plow blades attached on the front. Both the single straight-blade plows and the V-shaped plows are used. Large, heavy plows operated by tractors are little used at present, on account of their cumbersomeness and slow speed of operation. In some towns trucks with straight-blade plows operate in pairs, each cleaning one side of the road. This means that the road is cleared full width in one trip. Occasionally in very heavy storms it is necessary to use a second truck behind the one operating the plow, this second truck acting as a pusher.

Oversight—Following each ordinary storm and at intervals during particularly hard storms, the office of the county superintendent makes contact by means of the telephone with each of the town superintendents to learn just which roads are clean and ready for traffic, and whether or not he is experiencing any particular difficulty. After each storm of any length, inspectors from the county superintendent's office go over at least a portion of the roads on the snow cleaning map in each town, to see that they are properly cleaned and that traffic can pass easily. A careful record is kept of the progress of the snow cleaning during and following each storm, so that in case of inquiry, information can be given as to just which roads are passable and which are blocked by snow. The average cost of keeping the seven hundred miles of road open in Monroe County during the winter season of 1929-30 was approximately $21 per mile, exclusive of snow fence.

Sanding Hills—While the greater part of the roads in Monroe County are either fairly level or easy rolling grades, there are a number of hills on which some trouble was experienced due to ice. As usual, however, the complaints were found to be greatly exaggerated and to rise chiefly from the fact that motorists seemed to feel that they should be able to travel as fast on icy grades as they did on dry, level road. It was found that, during and following nearly all the ice storms, by using caution it was possible to go up and down some of the worst grades with little or no difficulty. Sand, salt, fine gravel and calcium chloride were used on these icy grades with fair success. In some instances, mixtures of sand and calcium

(*Continued on page 78*)

Truck Using V-Shaped Plow

Truck Using Straight-Blade Plow

Snow Removal in Genesee County, Michigan

Truck plows for ordinary work, tractor plows for deep drifts. Speed of 25 to 30 miles an hour aimed at. Winter the cheapest maintenance period of the year.

By John H. Dennis
County Engineer, Genesee Co., Michigan

THE present requirements of the public in and surrounding industrial cities the size of Flint demands uninterrupted traffic every day of the year. The transportation of nearly every type of commodity due to the present retail practice necessitates a uniform distribution. The chief industry of Flint is the manufacture of automobiles, and within a radius of sixty miles are Saginaw, Lansing, Pontiac and Detroit, where the same company operates other plants. Many of the parts are made in one city for automobiles built in other cities, which means that these parts must be delivered promptly and with an even flow in order to keep the assembly lines working and not cause costly tie-ups and laying off men. The greatly increased suburban population depending on the automobile to supply their needs such as passenger and school busses, mail delivery, milk trucks, etc., all add to the necessity of keeping the highways open at all times.

Genesee county has a total mileage of 673 miles of improved roads. All of this mileage was kept open continuously last winter except for a few hours' interruption on some of the least important roads, in spite of the fact that we had nearly twice the average snowfall and the most severe storms in over ten years. Our average snowfall for the past forty years has been 35 inches, whereas the past winter measured 63.4 inches. Snow removal is contingent on not only the depth, but also temperature as well as amount and velocity of wind, and our average temperature for the three months of maximum snow removal work, viz., December, January and February, is about 22°. However, the average temperature for the past winter dropped considerably below this point and was accompanied by considerable wind. Our maximum drifts were around ten feet deep.

The equipment used consisted of fifteen 3½-ton trucks equipped with plows and four 10-ton tractors. Both "V" type and one-way blade plows were used. Machines were all equipped with extra strong headlights for night work. Several smaller trucks were used for handling supplies such as gas and oil, repairs, etc., as well as transporting men.

It is a pretty well defined rule that snow removal must start with the storm and be continuous throughout the storm. The method of removal as well as type of equipment most effective depends largely on the intensity of the storm. The object is to remove the snow to a point where it will give no further trouble.

In a moderate storm the one-way truck blades operate best, and the snow is kept worked to the outside of the roadway as far as possible. In heavier storms it is necessary to use the "V" type truck plows in order to maintain traffic. The widening is then done as soon as possible with either the truck one-way blades or the "V" type.

When the banks get so high that the truck plows are unable to widen the road any further, the tractor plows are used. We have two one-way tractor plows, but find the "V" type more efficient under all conditions. This widening work is kept up until the snow has been pushed to the sides as far as the shoulders of the road will permit; unless, of course, another storm or further drifting forces us to start again in the middle in order to maintain traffic. It is essential, however, to keep the snow worked out as far as possible to provide room for the next deposit. A deep, narrow cut through drifts would soon fill with snow under bad drifting conditions and make it impossible with our equipment to open again. The average amount of snow we have to handle each year does not warrant the investment in rotary or other heavy-duty equipment and we must depend on lighter high-speed machinery. Not only that, but tractors operate so slowly that it would take a fleet to give reasonable service.

Widening with V-Shaped Plow with Side Wing

Where possible, we try to maintain a speed with the trucks of between 25 and 30 miles per hour. The faster the truck is operating, the greater the tendency to throw the snow to the outside of the highway; and the further the snow is thrown away from the travelled portion, the less the resultant bank or ridge that is formed; and it is this ridge which acts as a snow fence on the succeeding storms which causes further drifting to form. The tendency is to make the newer plows which are proving the most successful, in either the blade or "V" type, higher and with more curvature to the mold-board. The action is one of lifting and throwing, and with fairly dry snow and a truck speed of 30 miles per hour the snow can be fairly evenly distributed over a width of 25 to 30 feet. We use the blade plows more on the pavements with shorter beats and use the "V" type on gravel or less important roads in keeping a single track open for traffic.

Of course, all the equipment is kept in operation after the storm, widening out in preparation for the next storm.

The work is carried on continuously the full twenty-four hours per day until completed, the crews working in two shifts. Trouble as well as conditions are reported from various places in the county to the central garage, where a close check is kept on conditions and location of the various units. A wonderful opportunity to test the loyalty of an organization is afforded under some of these conditions, as it is anything but pleasant to be working in some of these storms with the mercury below zero and a good wind blowing. This is especially true at night, when there is more apt to be trouble than in the daytime, due to the machinery working too close to the shoulders of the road and occasionally slipping into the ditch. It is impossible to provide as good vision at night as in the daytime. Conditions as a rule are harder to work under at night, although, due to less traffic, the crews are able to accomplish more than during the day.

Our total cost for snow removal, and also ice removal on pavements where dangerous, for the 673 miles was $32,732.43 last winter. The average cost for pavements was about $70 per mile and for the gravel roads about $40 per mile. This total amounted to approximately 10 per cent of our yearly maintenance cost, and when it is considered that this covered a period of over three months, it is readily seen that this is the cheapest maintenance period of the entire year; and where there is any amount of traffic, the public has a right to expect twenty-four hour service per day throughout the year. Considering the cost of removal under average conditions, we consider it uneconomical to use snow fence, while making permanent barriers by means of planting of trees, etc., is entirely out of the question in a thickly settled country.

Snow Removal in Trenton, N. J.

Results aimed at and procedure. Most of equipment used is city-owned.

By Joseph E. English,
Engineer of Streets, Trenton, N. J.

SNOW removal work in Trenton is organized on the basis of accomplishing certain specific results as follows:

(1) Removal of snow from entire street roadway in the more important business section of the city.

(2) Operation of snow plows over all streets in order to open up as wide a lane as possible and prevent rutting of the snow and ice with its consequent injury to pavements.

(3) Removal of snow from street intersections and car stops along all trolley car routes.

(4) Clearing of areas in front of all street inlets in order that melted snow may readily reach the drains.

Snow removal work in the business district is accomplished by the use of two city-owned conveyor-type snow loaders. The snow is loaded on trucks and hauled to the nearest dump. Some of it is disposed of by dumping into the sewer manholes. Also, the city has constructed openings in a number of bridges crossing a stream which flows through the heart of the city, through which the snow is dumped. About five miles of business streets are cleaned in this manner. This work is expanding each year as a result of demands on the department to take in additional territory. Not a single criticism has been heard regarding the money spent for snow removal. The citizens seem to appreciate this service and want more of it.

For the work of plowing streets, the city is divided into districts and a plow assigned to each district. The plows operate continuously for several days after the snow has stopped falling and repeat a number of times on each street. Some difficulty is experienced with property owners who, in an effort to clear a space along the curb in front of their property, throw the snow out into the plowed lane. This makes it necessary to keep the plows operating longer than otherwise would be required. The department considers this phase of the snow work very important in preventing excessive wear on the pavements due to chained wheels running in ruts.

The cleaning of street intersections along trolley routes is done by hand labor and the snow is lifted and carted away. Approximately 220 street intersections are involved in this work.

The cleaning of the spaces in front of street inlets is done by the city's sewer maintenance force.

The work of removing the snow in the business district is done by city forces with city-owned equipment; except that additional trucks are hired to supplement the city-owned trucks. All plows are manned by city employees and the city owns the trucks and plows employed in this work. Several contractors are enlisted in the street intersection cleaning program, each being assigned to a definite route. These contractors are subject to call on short notice.

Because of the lack of a satisfactory unit of measurement which would serve in comparing costs, no unit costs are kept. The character of snow varies so much as to density and ease of handling, depending upon the conditions of the snow storm and those which prevail thereafter, that it seems to the writer that costs in any particular city would mean very little unless all of these factors could be known and considered. To clean an average snow storm of say, eight inches in depth, according to the above program, costs the department approximately between ten and twelve thousand dollars, exclusive of the overhead on city-owned equipment.

Operation of Flint Sewage Treatment Plant in 1929

Results obtained during second year of operation. Circulation of sludge reduces foaming in Imhoff tanks. Improvements in sludge drying. Experiments in odor control.

THE first fifteen months of operation of the sewage treatment plant of Flint, Mich., which went into service in October 1927, was described in our issue of June, 1929. The plant consists of bar screens, grit chambers and sewage pumps located in the city; also, about a mile outside the city limits, Imhoff tanks and sludge beds, connected with the pumping plant by means of a 50-inch steel force main.

During the second year of operation, ending December 31, 1929, some minor changes were made, the most important being the rearrangement of the outfall sewer so that the outlet is submerged and the installation of chlorination equipment, both designed to prevent odors.

The estimated connected population averaged 130,000 during the year. The total amount of sewage treated was 3,694 million gallons, or an average of 10,120,000 gallons a day, or 78 gallons per capita. The minimum day's flow was 6,050,000, on Sunday, August 25; the maximum was 17,890,000 following a steady three-day rain.

The regular operating force at the treatment plant consists of a chemist in charge, assistant chemist, laboratory assistant and three attendants; also three laborers and a team of horses during the summer months to handle dried sludge.

The spacing of the bars at the pumping station was reduced from 3-in. to 2-in. centers because of trouble with rags reaching the Imhoff tanks, and the screenings removed averaged 0.2 cu. ft. per million gallons of sewage, or about double that removed in 1928. The screens are cleaned at 8-hour intervals.

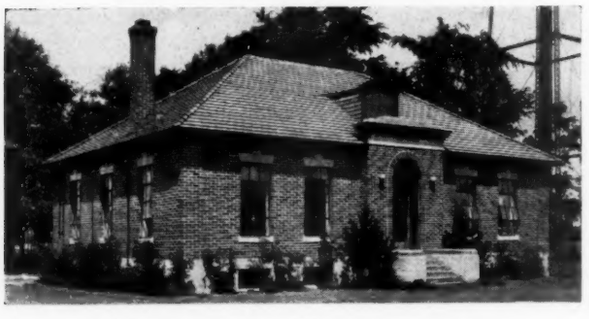
Imhoff Tanks.—The average removal of suspended solids in the tanks was 69.3 per cent, of suspended organic solids 65.5 per cent, and of settleable solids 95.1 per cent. The removal of suspended solids averaged 62.5 for the first six months and 74.6 for the last six. In 1928 also, the efficiency was greater during the latter half of the year and apparently improvement in the annual average depends upon improving that of the first six months. Foaming seems to be responsible in part, at least.

Foaming troubles during the past year were not as serious as during the previous year and the effect on efficiencies might not have been as great had not a number of methods of combating the trouble been tried, as a result of which the foaming continued for a considerable period of time on some of the tanks. The foaming control treatment consisted principally of a series of circulation experiments in which the sludge was circulated by means of air lifts.

As could be expected in using the tanks for experimental purposes, at times undesirable conditions were produced in some of the tanks, but a close record was kept of variations in order to be forewarned of impending troubles. The conclusions to be drawn from the experiments to date are that a small amount of circulation by air lift is helpful in promoting balanced digestion, principally by preventing heavy scum formation. Too frequent circulation (with air) produces a bulky sludge, although no other objection has been noted.

Circulation of sludge has been entirely successful in Flint in combating foaming troubles, as it provides a means of keeping the foam under control by mechanical action, and at the same time rapidly brings the digestion to a balanced state by making it possible to hold the partially digested sludge until digestion is more complete.

The average analysis of the sludge drawn to the beds during the season was 92.1 per cent moisture and 45.6 per cent organic, which, compared to the values of 92.9 and 49.1 per cent for the previous year, shows that the digestion was somewhat improved.



Administration Building, Sewage Plant

Average Analysis of Raw Sewage and Tank Effluent—1929

Month	Daily Million Gallons Treated Total	Inches Precipitation	—Parts per million daily average— cc per L Two-hour Settleable Solids		Suspended Solids		Suspended Volatile Solids		Oxygen Consumed		5-day B. O. D.	
			R	S	R	S	R	S	R	S	R	S
Jan.	10.04	2.04	4.8	0.4	220	85	177	71	73	47	349	168
Feb.	9.10	0.71	6.0	0.4	263	97	206	83	81	53	359	185
Mar.	12.16	2.73	4.2	0.3	204	87	151	73	64	43	244	137
April	13.21	4.27	4.3	0.3	200	79	114	56	54	37	212	114
May	12.85	3.83	4.3	0.4	202	72	139	59	53	37	224	129
June	9.90	2.37	6.5	0.4	258	86	182	68	72	45	338	175
July	9.58	1.58	6.9	0.3	304	84	201	62	73	43	364	176
Aug.	8.55	1.34	6.9	0.3	316	74	217	55	78	44	405	198
Sept.	8.62	1.29	7.6	0.3	294	67	210	52	79	45	412	214
Oct.	9.32	4.07	7.7	0.2	292	60	198	47	81	44	390	191
Nov.	9.28	1.73	7.1	0.2	260	61	185	49	73	46	329	162
Dec.	8.98	3.03	6.1	0.3	262	91	201	77	75	48	332	195
Aver.	10.11	2.41	6.1	0.3	256	79	182	63	71	44	330	171
1928												
Aver.	9.62	2.74	4.9	0.4	255	85	181	65	77	48	326	168

The average reduction in organic matter in the sludge due to liquification and gasification was 66 per cent, while the reduction in dry solids was 23.4 per cent. The organic content of the raw sludge was 71.1 per cent. The total raw solids deposited in the tanks during the year was 5,390,000 pounds.

The following table gives the analysis of the raw sewage and tank effluent together with plant efficiencies during the past two years:

Comparison of Sewage Analysis and Plant Efficiencies, 1928 and 1929.

	Raw Sewage		Effluent		% Reduction	
	1928	1929	1928	1929	1928	1929
Chloride	90	86	...	...	...	...
Ox. Cons.	77	71	48	44	37.7	37.9
5-day B. O. D. ...	326	330	168	171	48.4	48.2
Total Solids	928	895	750	718	19.2	19.8
Total Organic ...	490	490	374	372	23.7	24.7
Susp. Solids	255	256	85	79	66.7	69.3
Susp. Organic ...	181	182	65	63	64.1	65.5
Sett. Solids	4.9	6.1	0.4	0.3	91.9	95.1
Turbidity	311	261	156	125	49.9	52.1

Sludge Drying and Disposal.—Sludge drawing operations were started on April 2nd and continued until September 28. Due to a more efficient system of handling the sludge, the drawing and lifting operations were continuous. By lifting the dried sludge on a regular schedule, the labor required for this operation was reduced to three men and a team of horses. Two men would load the sludge on cars while the third with the team would take the cars to the dump and level off the sludge after dumping.

The labor-hours per cu. yd. of the dry sludge handled averaged .57 for the season.

A total of 25,725 cu. yds. of wet sludge was drawn, 23,310 cu. yds. being drawn to the beds and the remainder to adjacent low ground. The amount of sludge removed from the beds was 8,357 cu. yds., making a reduction of 64 per cent due to shrinkage. The number of beds filled was 210, the average number of fillings per bed during the season being 5.25. The average drying time was 29.5 days per bed.

The average analysis of the dried sludge was as follows:

Moisture	51.7%	Potash (K_2O)	0.12%
Organic	34.6%	Phosphates (P_2O_5)	1.10%
Nitrogen	1.96%	Fats (ether soluble)	7.3%

About two inches of sand was lost from the sludge drying beds during the two years of operation, due principally to sand adhering to the dried sludge that is removed.

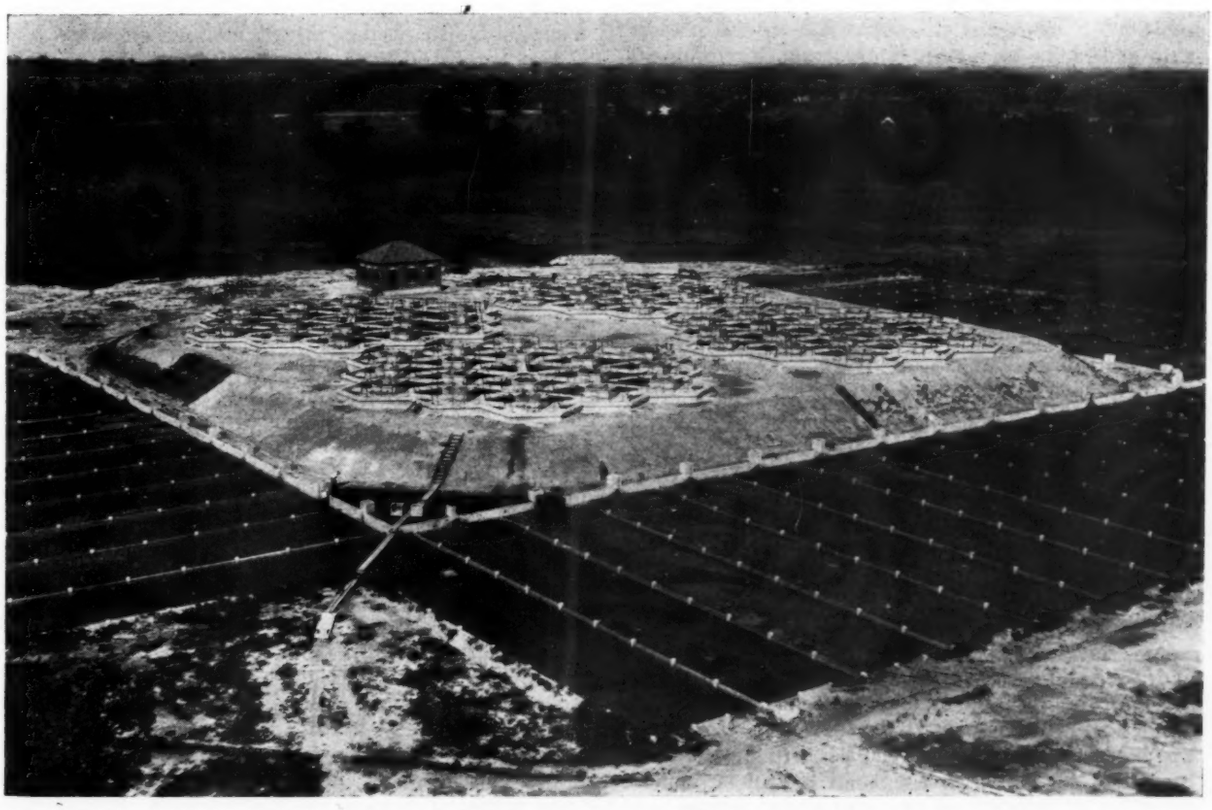
Costs.—The cost of treatment was as follows:

Power, lights, etc	$2,425.33
Plant supplies	2,577.97
Special equipment	815.14
Repairs	182.46
Labor, tanks	6,719.43
" sludge	2,398.10
" grounds	1,371.66
" repairs	36.76
" office and laboratory	7,983.71
Laboratory supplies	775.39
Total	$25,285.95

The cost of handling the 8,354 cu. yds. of dry sludge averaged 28.7 cts. per cubic yard.

The cost of treatment averaged 18.7 cts. per capita of connected population, or $6.58 per million gallons. Pumping cost 26 cts. per capita, or $9.16 per million gallons.

The cost for power was greater at the treatment plant than in 1928 because of greater use of the com-



Flint Sewage Treatment Plant.

Sewage Pumping Station.

pressor for aeration, outdoor lights and heating the water supply tanks in winter.

Investigation and Research.—In order to obtain maximum digestion efficiency from the tanks and control foaming, laboratory studies were made on sludge digestion, and experiments in the tanks on circulation and liming. As a result, foaming was overcome, the digested sludge is of better quality than formerly, and heavy scum layers in the gas vents (which offered a problem) are disappearing. It was expected that at least one of the tanks would foam again this spring, but the chemist in charge, Harry E. Johnson, felt confident that eventually the operation of the tanks can be controlled with exactness. Circulation with air for one or two hours once a month was found to keep the scum down and promote uniform digestion without bulking of sludge.

As a result of experiments in odor control, the following plan was decided upon for this year:

1. Prechlorination of the raw sewage at the Pumping Station to retard decomposition in the pressure main and tanks, to destroy odors at the Pumping Station and tanks, and to reduce the chlorine demand at the Treatment Plant. This treatment is to be intermittent, taking place only during the peak daily flows.

2. Postchlorination of the tank effluent shortly before discharge into the stream. This treatment is to be continuous and complete, the purpose being to reduce the 1-day B.O.D. of the effluent to a point where the oxygen balance of the stream below the plant will not be affected to a serious extent.

As water was not available at the Treatment Plant in an amount sufficient for operation of solution feed machines, considerable difficulty was experienced in applying the large amounts of chlorine needed directly without loss of free chlorine and with a satisfactory degree of efficiency.

The initial dry feed setup, using a silver grid diffuser, gave only 60 per cent efficiency on chlorine and the grid became useless within a week's time due to clogging with silver chloride. An immediate improvement in the stream below the outfall was noted during the time of treatment although chlorination was not complete.

A second installation of dry feed machines using hydraulic diffusers was arranged with the result that a trial run gave 100 per cent efficiency on chlorine applied at a rate of 2000 lbs. per day. Indications are that the mechanical difficulties will be ironed out by spring so that a thorough study can be made of the effect of chlorine on the sewage and stream.

The problem of industrial wastes has entered into the problem of odors in several ways. Primarily, any waste containing large amounts of sulphates adds to the odor troubles due to hydrogen sulphide production by bacterial decomposition of the sulphates in the sewers. In addition to the increased odor nuisance, the difficulty of treatment increases as well because of the added load on the chlorinating apparatus. It is much more economical to prevent odor production than to destroy odors already formed.

Other wastes may not contribute to the odors but are objectionable because of their high chlorine consuming qualities. It may be possible to have both objections present in a single waste, as was found in a particular instance. Plans are in progress to give these wastes preliminary treatment probably with chlorine at their source.

In connection with the stream studies it was noticed that certain wastes were being discharged directly into the stream in the city above the Treatment Plant, and although these wastes did not cause a serious condition in the stream above the plant, yet the available oxygen in the stream was reduced considerably due to their presence. These wastes are being diverted to the sanitary sewers, with preliminary treatment where necessary, and their elimination from the stream should do a great deal toward improving the condition below the treatment plant outfall.

Snow Handling in Gloversville

By H. J. Hanmer
City Engineer, Gloversville, N. Y.

THE cost of snow removal to the City of Gloversville, N. Y., during the past winter of 1929-1930 was $6,425. This item of expense was made up of the cost of hauling, plowing and the carrying of a crew of men on the payroll between storms.

Hauling 7,166 Ford dump-truck loads of snow from the city streets cost $5,093, or about 71 cents per load; which cost included loading the trucks by hand, as the city does not own any snow-loading equipment.

The cost of plowing and scraping the snow was $932. The carrying of a crew of men for snow removal was $400.

The city's snow removal equipment consists of one Acme road machine, one International 3-ton truck, two Relay 3-ton trucks, one 5-ton and one 10-ton Holt tractor, all equipped with snow plows; three Model T and three Model A Ford trucks equipped with dump bodies.

The city owns about 3,800 feet of picket fence and about 1,600 feet of slab fence which it erects in the outlying districts for the purpose of drift prevention. It cost the city $452 last winter to maintain this fence, erect and dismantle it, and repair same.

Our snow removal crew is organized when the first snow fall occurs in the winter, and is held until we feel reasonably sure we will get no more snow the following spring. As soon as we have a snow fall of five or six inches, the plows are started out and continue their work until the streets are cleared of snow. All snow is hauled from the business section after each snow fall and from some of the principal street intersections in the outlying districts.

The city has been forty-five and fifty miles of streets and roads from which it plows the snow, and about two miles of streets in the business section from which it hauls the snow.

New Methods in County Highway Construction in New York State

Counties must now prepare program for five years ahead. Five sources of income. Niagara County has more than a million dollars available for this year. Analysis of costs for the several types of pavement.

By Richard M. Rumsey
County Superintendent of Highways, Niagara County, New York

Completed pavement on Hinman Road.

OLD methods of planning and executing county road programs have been materially altered in New York by the passage of new state laws aimed at more rigid supervision and control. Previous to 1929, each year's construction program was formulated without any apparent regard for that of the preceding years or of the years to follow. This hit or miss scheme made for waste and inefficiency, political expediency rather than engineering foresight, and an unbalanced road program. Several concrete roads have been built which are practically useless for the want of a few additional miles to make them connecting links between main highways. In other places, money was wasted by building fine concrete roads where a good black-top road would have sufficed for the traffic needs.

In 1929, section 320-B of the state highway law was amended so that every county now is compelled to draft a map outlining the construction program for five years in advance. This plan must be approved by the Board of Supervisors and the Department of Public Works before going into effect, although changes may be made from time to time with the consent of the various groups. State aid money is available only for road construction as outlined in this map, and any roads which the county builds which are not included in this plan must be paid for by the county itself. After the five-year program has been approved, each annual program also must be approved by the Commissioner of Public Works at Albany.

This would seem to guarantee that after a period of five years each county will have not only new important roads but the necessary links to make the whole road system practicable. It substitutes a unified and just system of highways for the previous favoritism and sectionalism. If the commission should find that any questionable methods are employed in the construction of the highway, it may demand changes in these, and reserves the right of final inspection. It is believed that the county highway construction will shortly reach the same healthy condition found in state highway construction, which long ago was taken out of partisan politics and placed upon a scientific and intelligent basis.

A comparison of the old methods and the new may be made by describing what has taken place in Niagara county, in the western part of the state, which for years has been a leader in road building, having spent almost a million dollars annually for the past three years.

Methods of Finance

The county highway work is financed by five separate incomes, viz: 1. Lowman money; 2. Vehicle tax; 3. Gasoline tax; 4. County appropriation; 5. Town share.

Lowman money is that made available by a state law which guarantees $30 per mile state aid for each mile of unimproved county road, the county raising an equal sum by appropriation in order to benefit by it. The vehicle tax money is the county's share of the auto license fees collected by the state. The gas tax is similarly the county's share of the gasoline tax (2c per gallon of gasoline), collected by the state, the money being appropriated to the various counties

TABLE 1—ENGINEERING COSTS

Amount Paid Contractor	Design	%	Supervision	%	Final Estimate	%	Total Engineering	%	Progress
$77,322.98	$932.58	1.2					$1,448.90	1.87	Good
67,718.74	848.59	1.3	$1,494.19	2.2	$372.15	.55	2,714.93	4.00	Fair
231,501.49	2,110.38	.91	2,218.66	.96	701.95	.30	5,030.99	2.10	Excellent
50,396.30	411.45	.81	923.22	1.84	191.47	.38	1,526.14	3.0	Fair
14,525.64	255.16	1.75	293.95	2.00	134.50	.92	683.61	4.7	Good
96,245.39	675.11	0.70	1,417.12	1.47	414.02	.43	2,506.25	2.6	Excellent
12,886.41	176.09	1.37	381.60	2.96	84.80	.67	642.49	5.0	Fair
43,573.47	301.53	0.69	796.15	1.83	226.51	.52	1,424.19	3.26	Good
113,715.60	564.63	0.50	1,840.37	1.62	363.56	.32	2.738.56	2.4	Fair
20,347.62	113.78	0.56	608.11	3.00	96.09	.47	817.98	4.0	Fair
79,657.37	996.65	1.25	1,800.12	2.25	432.83	.53	3,220.63	4.0	Fair
64,155.77	554.33	0.86	2,337.47	3.68	275.35	.43	3,167.15	4.9	Poor
7,589.65	129.04	1.7	108.14	1.42	44.00	.58	281.18	3.7	Fair
37,222.73	464.64	1.25	985.23	2.64	198.61	.53	1,648.48	4.4	Poor Excavating
71,516.77	1,018.19	1.42	1,591.31	2.23	413.12	.57	3.022.62	4.2	Fair
	Average	1.26	Average	2.25	Average	.57	Average	4.04	

NIAGARA COUNTY DEPARTMENT OF HIGHWAYS
DAILY TIME REPORT

Date.....19...

Road Number..... Name..... Hour Time.....

PRELIMINARY	Plotting Topography Sta.	to Sta.
	Reducing Cross Section Notes Sta.	to Sta.
	Checking Cross Section Notes Sta.	to Sta.
	Plotting Profile Sta.	to Sta.
	Inking Profile Sta.	to Sta.
	Plotting Cross Sections Sta.	to Sta.
	Checking Cross Sections Sta.	to Sta.
	Inking Cross Sections Sta.	to Sta.
	Putting on Template Sta.	to Sta.
	Planimetering Cross Sections Sta.	to Sta.
	Tracing First Sheets	Hours
	Tracing Profile Sta.	to Sta.
	Tracing Topography Sta.	to Sta.
	Balancing Road Sta.	to Sta. Hours
	Drainage Structures Sta.	to Sta. Hours
	Making up Grade Book	Hours
FINAL	Reducing Cross Section Notes Sta.	to Sta.
	Checking Cross Section Notes Sta.	to Sta.
	Plotting Cross Section Sta.	to Sta.
	Checking of Plotting Sta.	to Sta.
	Inking Cross Sections Sta.	to Sta.
	Planimetering Cross Sections Sta.	to Sta.
	Checking Planimetering Sta.	to Sta.
	Computing Final Earth Work Sta.	to Sta.
	Work on Final Estimate Book	Hours

Signed .....

Title .....

Blank used for Daily Time Sheet

on the basis of mileage of unimproved roads. For every dollar allotted for construction by the county, each town in which the highway is to be constructed must add 30c towards the cost.

Niagara County's total budget at the disposal of the highway department for 1930 is as follows:

1. Lowman money	$28,020
2. Vehicle tax	$120,000
3. Gas tax	$48,000
4. County Appropriation:	
Road Appropriation	$630,000
Bridges	$30,000
Right of way	$86,000
Total	$942,020
Less Maintenance	$120,000
Balance	$822,020
5. 30 per cent by town's share	$246,606
Amount available for new construction	$1,068,626

The item of $120,000, "Less Maintenance," is deducted because the towns are exempt from this item of cost.

Types of Pavements

Niagara County has built three types of pavements —concrete, macadam and brick, with concrete leading. During the past three years they have averaged 19.3 miles of concrete, 7 miles of macadam and 4.36 miles of brick.

While concrete has been the popular road, there are several cases where a cheaper road would have been more economical. On one seven-mile stretch of concrete road the traffic count has been 300 vehicles for 24 hours, of which only six per cent are over 3½ tons. This road could better have been built of macadam. In Niagara County macadam pavements with a depth of 14 inches can be laid for the price of 7 inches of concrete, and it is the writer's personal opinion that the former, if properly constructed, is the more durable.

Production Cost

The writer believes that Niagara County has a splendid record in both engineering and construction costs. It has adopted a simple cost-keeping ledger, in which all charges against the road are entered, and are subdivided under the heads of 1. Preliminary survey. 2. Design. 3. Staking out. 4. Advertising. 5. Blueprints. 6. Engineering. 7. Final survey. 8 Amount paid contractor.

On the left hand page a complete record of the road is kept, showing: 1. Length. 2. Type. 3. Thickness. 4. Contractor's bids plus 10 per cent for engineering, etc. 5. Amount of money advanced by county, town, etc. 6. Contractor's name. 7. Cost of each item as listed above.

As each item of progress is completed, the total cost is transferred to the left hand sheet under its respective heading, so that it is possible at a glance to determine how costs on any job are running. The men working in the office fill out a daily time sheet at the close of each day. Those in the field file a report bi-monthly showing time and progress made. All charges against a road are paid by vouchers which are recorded in black on the right hand page of the ledger, except that the money paid the contractor is shown in red. This permits separating the engineering from the construction costs with a minimum of effort.

With records so kept, it is possible to extract any costs desired, as shown in the table. Here the headings are Design—preliminary survey to staking out, inclusive. Supervision—including actual construction. Final estimate—the final survey and estimate. Total engineering—a total of the first three mentioned. Finally, actual amount paid contractor.

This table shows figures classified as above for all roads built in the county during the past three years. At first inspection it might seem that there is a lack of consistency in the results, but if we examine concrete construction for illustration, and break it up into the various degrees of progress, the result appears

(*Continued on page 76*)

TABLE 2—ANALYSIS OF HIGHWAY COSTS (INCLUDING ENGINEERING COSTS)

Contractor	Road No.	Type Pavement	Width	Length, Miles	Thickness	Total Cost	Cost Per Mile
W. Whitmore	6A	Brick	18′	1.71	3″ 6″ Conc.	$79,642.91	$46,573.80
Frehees & Whitmore	64	Concrete	16′	2.045	7″	70,471.85	34,375.51
H. W. Patterson	65	Concrete	16′	7.335	7″	237,798.91	32,441.87
J. Irwin	66	Concrete	16′	1.725	7″	51,946.30	30,201.33
J. Irwin	67	Concrete	16′	.45	8-7-8	15,221.53	33,825.63
J. Irwin	69	Concrete	30-40	1.59	7″	98,761.61	62,114.22
J. Meahl	70	Concrete	30 Var	.23	7″ Conc. 2″ Mac.	13,540.21	58,870.47
W. Whitmore	71	Concrete	16′	1.45	7″	45,001.56	31,035.56
Wm. Gould	6-B	Brick	18′	2.65	3″ 6″ Conc.	116,458.06	43,946.43
J. Irwin	8-A	Concrete	18′	.46	8″	21,169.50	46,021.65
Wilson & Shardon	73	Concrete	18′	2.06	7″	82,120.79	39,864.46
Bewley & Gould	74	Macadam	16′	2.49	14″	67,794.42	27,226.67
W. Whitmore	75	Concrete	18′	.195	7″	7,790.16	41,000.84
W. Whitmore	76	Concrete	16′	1.25	7″	38,503.64	30,802.91
W. Whitmore	77	Concrete	16′	2.36	7″	73,709.33	31,232.76

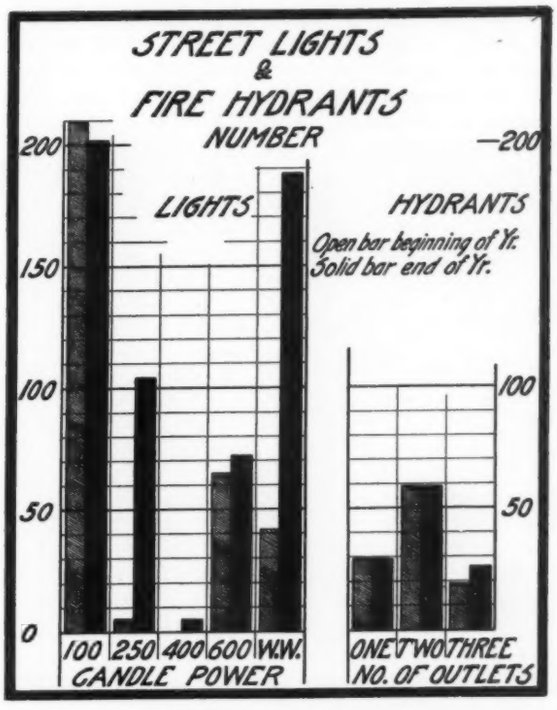
Graphic Charts in Municipal Reports

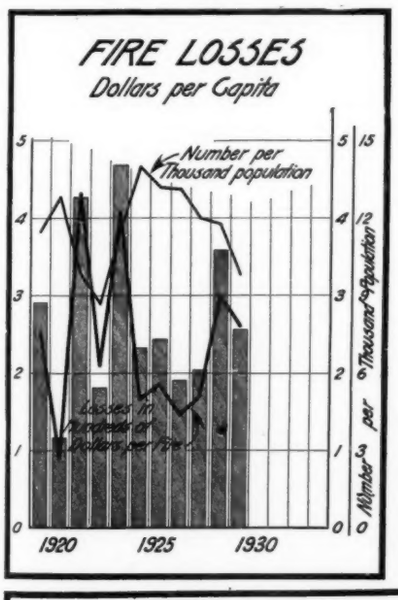
By E. C. Garvin
City Manager, Brunswick, Ga.

WHILE the graphic method of presenting municipal statistics in special and annual reports is slowly making headway, its use is not as general as its advantages justify. Knowledge of the results being obtained in each department of a business is the foundation on which success is built. Improvement in method must start with the fact established that existing method is unsatisfactory. Improvement in performance must begin with a knowledge of what that performance is.

How often have we studied a column of figures representing some vital function of our business without grasping its real significance? The method of conveying information through the eye by means of curves and pictures is convenient, quick and lasting. The shape of a curve will be remembered long after a column of figures is forgotten. The trend shown by its direction is at once apparent.

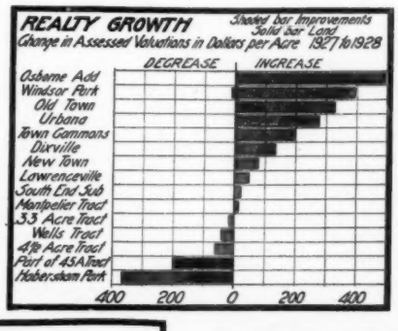
The charts generally applicable to municipal reports are those representing monthly comparisons throughout the year or yearly comparisons over a long period. Theoretically the municipal report is intended for the tax payer as a summary of the city activities he supports. Practically it is much more valuable to the conscientious city executive than to

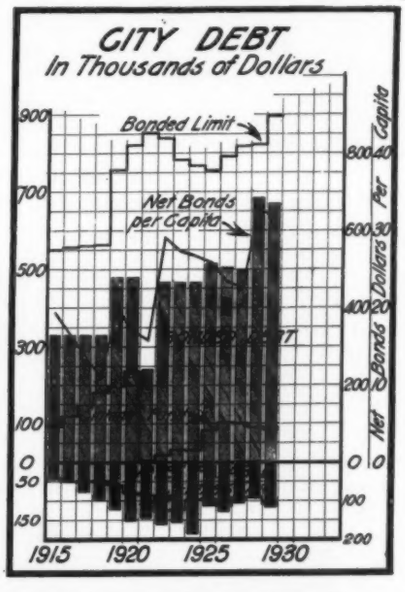


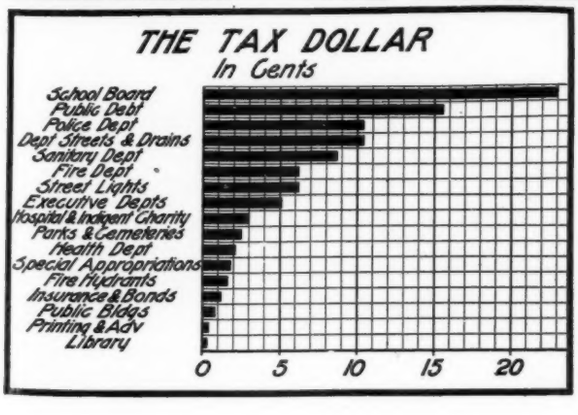


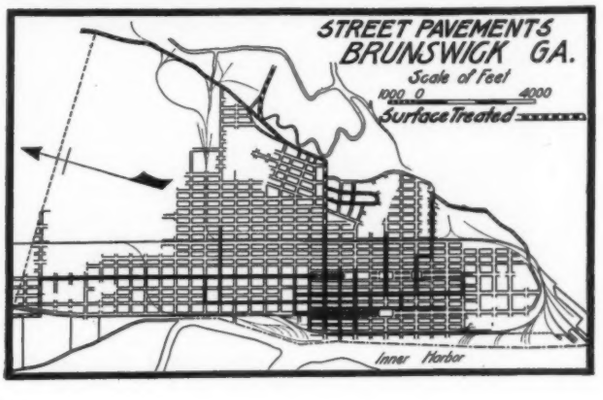
Some of the Graphic Charts (reduced one-half in size) used in the Ninth Annual Report of the City Manager of Brunswick, Georgia.

Of the 44 pages in this report, 19 are devoted to charts and 9 to maps and pictures.









any citizen. To meet the demands of both theory and practice all municipal charts should be of the simplest type which will show the data clearly. If two draftsmen prepare similar charts from the same data, the one which is the more pleasing to the eye will command the greater confidence though it may in fact be less accurate than the other. Simplicity and attractiveness are important features in charts intended for the general public.

Adhering to the fundamental principle urging the use of graphic charts in the place of figures by appeal to the eye, a few of the charts used in the annual reports of the city of Brunswick, Ga. are shown.

Preparing Sand and Gravel for Wyman Dam

WYMAN DAM is being built across the Kennebec river by the Central Maine Power Company at a cost of $11,000,000. One of the interesting features of the construction is the preparation of sand and gravel for the concrete. The location of the dam made it too expensive to bring in sand and gravel from established pits; but there were deposits a few miles from the dam site and it was decided to develop these and bring the prepared aggregates to the dam by constructing a railroad, although the cost of both this and the plant must be written off in the two years of construction of this dam.

Construction was to be continued through the cold of two Maine winters but it was decided to discontinue sand and gravel washing during the cold spells, storing sufficient to carry over such periods. Storage of 100,000 tons of washed sand and gravel was provided therefore.

The sand and gravel, which has a depth of not exceeding ten feet, is removed by power shovels and discharged into side-dump cars, which are hauled by locomotive to a hopper, where they discharge their loads. The material passes through a grizzly and is fed to a continuous bucket elevator with a capacity of 125 tons an hour, which raises it and discharges it into a scrubber elevated on a trestle, which in turn discharges the washed material into two Dull conical revolving screens, which separate it into three sizes and discharge it into bins.

The material as dug consists of gravel 4-inch size and smaller, down to sand and a small amount of loam, there being approximately twice as much gravel as sand.

The scrubber is a revolving cylindrical tank or shell with internal rings which divide it into several compartments which retard the progress of the material through the scrubber, while vanes raise the material and drop it into a bath of water. The lumps are thus broken up and the loam washed out.

The screens separate the washed material into grades of 4" to 1¼" gravel, 1¼" to ⅜" gravel, and sand. The last is washed over two Caldwell dewatering screws and the overflow from these is passed through a 60" diameter Dull settling tank. The dewatering screw consists of a screw conveyor mounted on pipes and set at the proper angle to de-water and drain the sand as the screw forces the material up the incline, the agitation of the sand in the water by the screw cleansing it.

Under the storage bins is a long belt conveyor, onto which the material can be discharged from any bin by means of gates with which each bin is provided. This belt conveyor, horizontal under the bins, rises beyond, bringing the head or discharge end several feet above the ground, where it discharges the material onto a portable belt conveyor 100 feet long. The latter is pivoted at the receiving end and mounted on radial wheels so that it can swing in an arc and feed another 100-foot portable conveyor, which in turn deposits the material in an annular pile of about 200 feet radius. There are two of the final storage conveyors, one for sand and the other for gravel. All four belt conveyors are provided with Link-Belt antifriction idlers with Timken bearings.

The entire area enclosed by the storage pile has been filled in with washed sand and gravel and acts as extra storage. The base of the storage pile proper is 20 feet below the level of the portable conveyors, and the height of the latter permits forming a pile about 40 feet high with a radius of 200 feet.

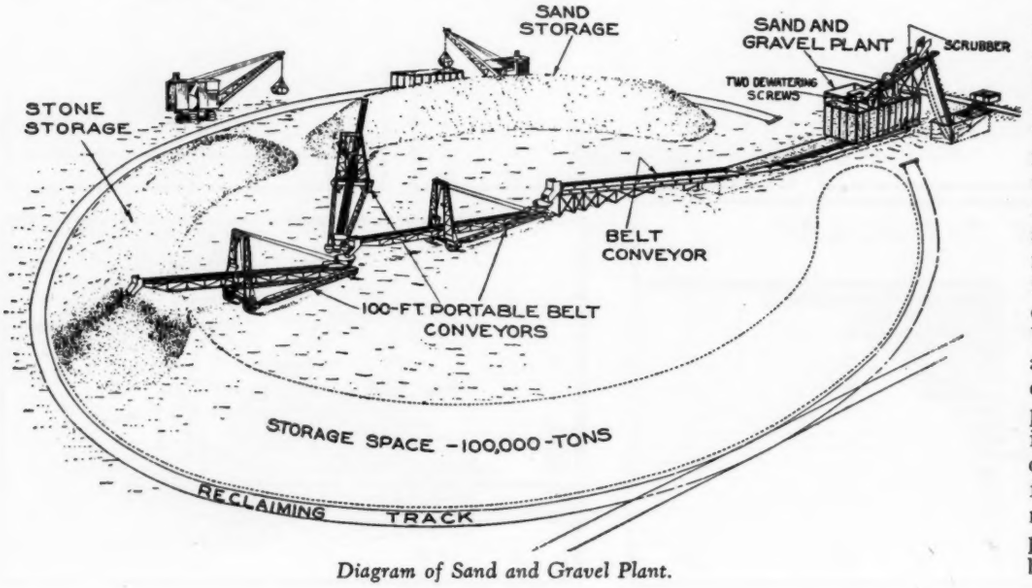


Diagram of Sand and Gravel Plant.

Outside of this entire storage space is a standard railroad track, on which cars are run to receive the material from the storage pile, the reclaiming being done by crawler cranes. Under the pile at one end, the company has placed a tunnel, into which the cars can be run for quick shipment, the prepared materials being overhead.

Foundation for Cobble Mountain Dam

By H. H. Hatch, M. Am. Soc. C. E.
Division Engineer

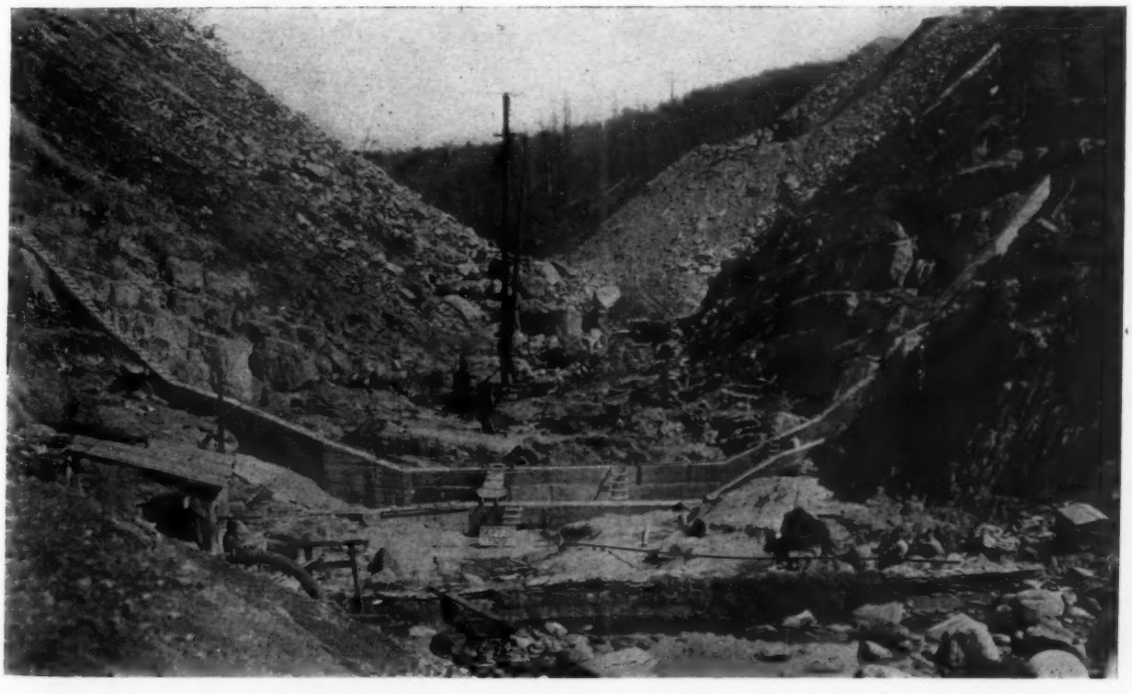
An article in the June issue of PUBLIC WORKS *described the construction of Cobble Mountain dam by Springfield, Mass., using the hydraulic fill method. It was not possible to describe all the interesting features of the project within the limits of a single article, and this and one or two succeeding articles will discuss several others, including the foundation work, which is the subject of this article.*

COBBLE MOUNTAIN dam is located in a narrow gorge at the bottom of the northern slope of Cobble Mountain. The bottom and the steep slopes on both sides are of solid rock, the characteristic mica-schist of that region. In fact, almost the entire water shed above the dam is steep, with little earth cover on the rock to provide ground storage, and a mean annual rainfall of 48 inches on 46 square miles gives an average run-off of 58 m.g.d., about 70 per cent of it taking place during a few weeks of the year.

For twenty years past the city has had this site in mind as a possibility for the future, and the nature of the rock in the bottom and sides of the gorge was investigated by means of open trenches and small test tunnels, in order to learn if there was any fault line within the outline or in the neighborhood of the dam. Test pits were dug all over the nearby areas to locate and estimate the quantity of materials suitable for concrete aggregates and hydraulic fill.

The water-tightness of the reservoir depends upon

Cut-off wall at right. Concrete chute in center.



Looking down stream across cut-off walls. In foreground, sand bag dyke used to dry up the foundation before the final clean-up.

that of the dam and of the rock under the dam. The core is the chief reliance for water tightness of the dam; and the foundation of the core section, both at the bottom and along the slope on each side, was thoroughly cleaned out and excavated to perfectly sound rock. In the core is a concrete cut-off wall 3 ft. by 8 ft., extending across the bottom and all the way up each side, extending into the rock 5 ft. lower than the bottom of the core trench. The width of this wall was supposed to be 3 ft., but in the foundation was invariably wider than 3 ft. due to irregularity of the blasted rock. The trench was completely filled with concrete up to the surface of the rock, and the concrete continues as a 3 x 3 ft. wall above this. There is also a second cut-off wall 30 feet from the first and similar to it except that it extends up each slope only 40 ft. above the bottom.

As seamy rocks at the bottom of the foundation of the dam may result in leakage and other serious consequences, the rock in the cut-off trench was grouted to insure a perfect sealing of all the crevices. Holes 15 feet deep were drilled about 10 feet apart all along each of the cut-off walls. The depth of the holes was measured from the bottom of the foundation trench.

Grout Pipes in cut-off wall trench. In center, bulkhead for pouring concrete foundation.

The mix of the grout varied from 3 to 10 parts of water to one part of cement. Pressure was started at about 10 pounds, and as the resistance increased the pressure was increased correspondingly up to 40 or 50 pounds per square inch. No grout hole was considered complete until it refused to take any more grout at this pressure.

The lump sum price for this work was $4,000 for 1500 feet length of grout holes and 400 bags of cement; figuring almost $1.50 per foot of drill holes and $17.50 per barrel of cement pumped in as grout, or 150 cu. yds of grout at $12 for a 10 to 1 mix. The drilling cost the contractor about $1.00 per foot, and the grout about $8.00 per cubic yard.

In order that there might be no doubt that the crevices of the rock were sealed, the contractor put down eight additional holes in the bottom of the cut-off trench, each about 25 feet deep, and grouted them like the 15-foot holes. The cost for 196 feet of these, grouted with 336 bags of cement, was $815.

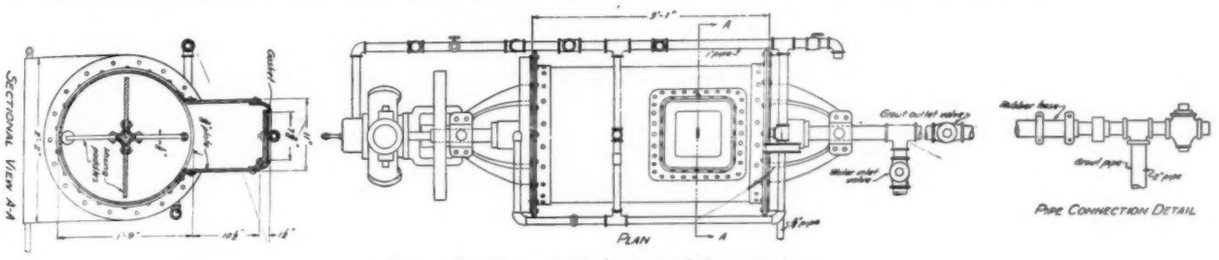
Unit prices for grouting per hole or per square foot of foundation area are misleading. It is easy

Near view of cut-off walls, completed and being cleaned up preparatory to sluicing.

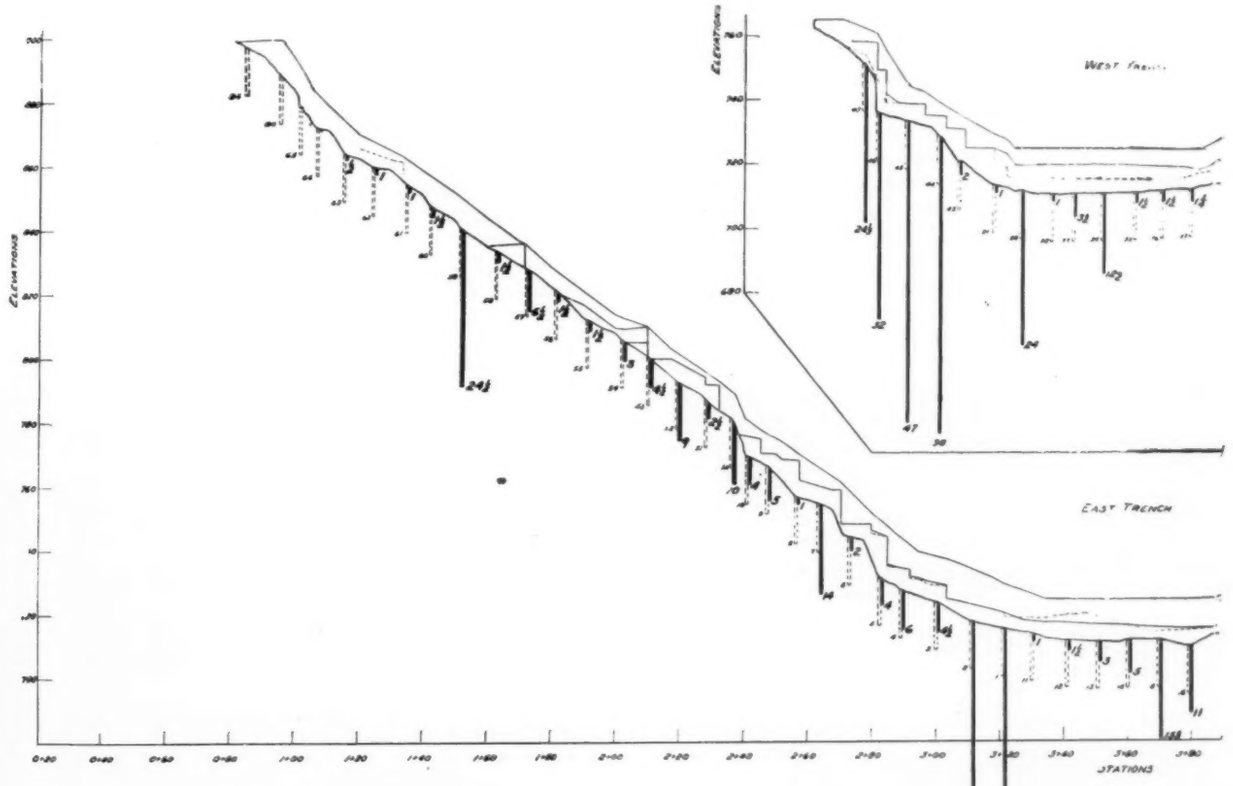
enough to estimate and do the drilling at so much per lineal foot, the price varying according to locality and kind of rock. The grouting, however, is blind work—no one can tell what there is and what kind of seams there are under the surface of the rock. In this particular job some grout holes did not take more than half a bag of cement grout, while others took more than 200 bags. The total amount used was well above the estimate.

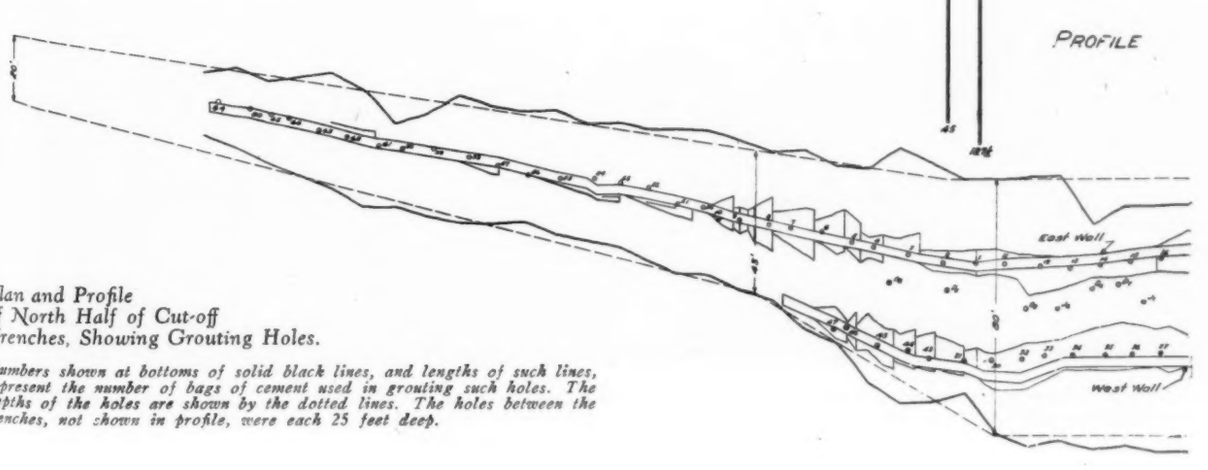
The machine used for grouting at Cobble Mt. consisted of a metal chamber of about 7 cu. ft. capacity with inlet water and air connections and an outlet for the discharge of grout. It also has a small hole in the top which can be closed by a flap-valve gate

(*Continued on page 74*)



Plan and section of machine used for grouting.





Plan and Profile of North Half of Cut-off Trenches, Showing Grouting Holes.

Numbers shown at bottoms of solid black lines, and lengths of such lines, represent the number of bags of cement used in grouting such holes. The depths of the holes are shown by the dotted lines. The holes between the trenches, not shown in profile, were each 25 feet deep.

Efficient Operation of Concrete Paving in Pennsylvania

Highway Department aims to aid contractors in securing maximum rate of construction, and thereby reducing cost, without sacrificing high quality. Last year the average efficiency of the contractors was less than sixty per cent of that theoretically possible. How efforts are made to better this.

By P. M. Tebbs

Assistant Chief Engineer, Pennsylvania Dept. of Highways

THE policy of the Pennsylvania Department of Highways has been, and will continue to be, "Maximum production of concrete pavement at the cheapest possible cost consistent with the highest quality and fair profit to the contractor producing it." We will control the quality and insure it by constant inspection. The question of the fair profit is dependent entirely upon the production by the contractor of the class of pavement upon which we insist.

A study of the results secured in 1929 proves conclusively that we are improving steadily the quality of our pavements. Our records* of each individual project show we are securing proper cement content, full depth and width of slab, proper proportioning, uniform consistency and uniformly good riding qualities.. The cooperation we have received from our contractors, especially in securing smoothness, has been most gratifying and we are assured of the continuation of this spirit.

Our studies will be continued through 1930 and amplified with a view of securing still better results in quality production.

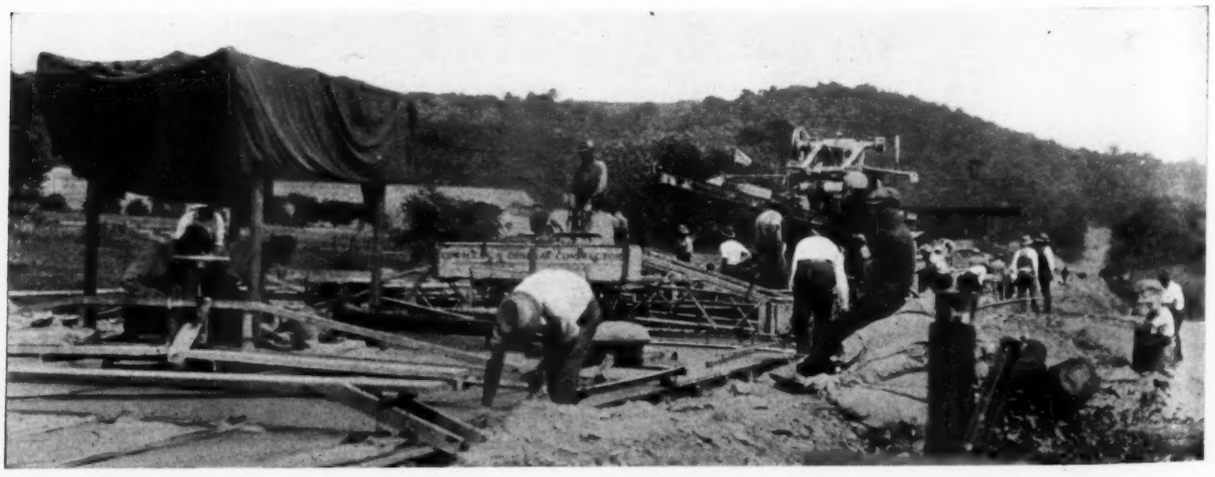
Our records show, however, that we have *not* secured generally the quantity production so vitally necessary to improve the financial condition of the contractor and the construction paving industry in general.

*The field data used in this article were furnished by C. H. Buckius, construction engineer, the author's field representative on construction work.

The table on page 35 gives a summary of efficiency reports on concrete paving operations by 206 separate paving units on 454.93 miles of concrete pavement in all sections of Pennsylvania placed in 1929.

The first outstanding fact in this report is that contractors lost, through their own inefficiency, 23.6 per cent of the total available paving time. Bad weather and wet subgrade conditions were eliminated from these calculations and only such time was considered under "Possible Number of Working Hours," as the contractor could have operated his paving outfit. This percentage of lost time varies from a minimum of 12 per cent in Division No. 7 to 35 per cent in Division No. 6.

The next outstanding feature is that when pavers were operating, only an average of 99.57 square yards per hour were placed. Division No. 5 with 78.49 square yards per hour has the poorest record, and Division No. 7 with 115.00 square yards has the best. Most of the pavement laid was 18 feet wide, 9 inches deep at the edges and 7 inches in the center. A 27-E paver (which was the predominating type in use) is capable of placing 40 batches per hour with 1¼ minute mixing time. But the 1929 average is only 23 batches per hour. This is less than 60 per cent of maximum efficiency. I cannot conceive of any manufacturing industry existing, to mention nothing of making a profit, which utilizes less than 77 per cent



Line-up of equipment, from right to left: Concrete mixer, finishing machine, and finishing center joint under movable shelter; straightedging between first two; burlap placed immediately after center joint is finished. It is advantageous to keep all these operations as close together as possible.

Summary of Efficiency Reports on Concrete Paving Operations During the Year 1929

Division No.	Length Paved 1929—Mi.	No. Sq. Yds. Paved 1929	Working Hours: Possible Number	Working Hours: Hours Lost	Working Hours: Actual Number	Per Cent. Time Lost	No. Sq. Yds. Pavement Laid Per Working Hour
1	102.10	1,068,836.41	12,121.37	2,177.42	9,943.95	18.0	107.5
2	30.76	314,328.00	3,665.00	544.915	3,120.085	14.86	100.74
3	59.05	657,263.00	7,653.25	1,437.00	6,216.25	18.8	106.00
4	53.10	572,565.00	7,320.00	1,777.00	5,543.00	24.0	103.00
5	72.34	824,070.00	14,144.00	3,645.50	10,498.50	25.78	78.49
6	59.64	641,979.00	9,862.00	3,454.00	6,408.00	35.0	100.18
7	34.95	389,068.00	3,839.00	455.00	3,384.00	12.0	115.00
8	42.99	491,852.20	6,604.25	1,904.25	4,700.00	28.8	104.70
Grand Total—State	454.93	4,959,961.61	65,208.87	15,395.08	49,813.79	23.6	99.57

Reason for Lost Time

No.	Transportation: Hours	Transportation: Per Cent.	Water Conditions: Hours	Water Conditions: Per Cent.	Sub-grade and Forms: Hours	Sub-grade and Forms: Per Cent.	Breakdowns: Hours	Breakdowns: Per Cent.	Lack of Materials: Hours	Lack of Materials: Per Cent	All Other Causes: Hours	All Other Causes: Per Cent
1	336.27	2.8	110.35	0.9	458.42	3.8	483.19	4.0	481.55	4.0	307.64	2.5
2	11.0	0.30	11.833	0.32	116.583	3.18	117.416	3.20	87.00	2.37	201.083	5.49
3	89.00	1.2	21.75	0.3	139.50	1.8	276.50	3.6	237.75	3.1	672.50	8.8
4	290.0	4.0	79.0	1.0	489.0	7.0	198.0	3.0	325.0	4.0	396.0	5.0
5	271.00	1.92	172.25	1.22	1,080.75	7.64	516.50	3.65	421.50	2.98	1,183.50	8.37
6	201.00	2.0	154.00	2.0	815.00	8.0	366.00	4.00	880.00	9.0	1,038.00	10.0
7	132.00	4.0	36.00	1.0	124.00	3.0	92.00	2.0	35.00	1.0	36.00	1.0
8	370.00	5.6	80.75	1.2	429.25	6.5	252.25	3.8	140.25	2.1	631.75	9.6
Grand Total State	1,700.27	2.61	665.93	1.02	3,652.50	5.60	2,301.86	3.53	2,608.05	4.00	4,466.47	6.85
Per cent of total		11.05		4.32		23.72		14.95		16.94		29.02

of its available time and operates at only 60 per cent of its maximum efficiency when in action.

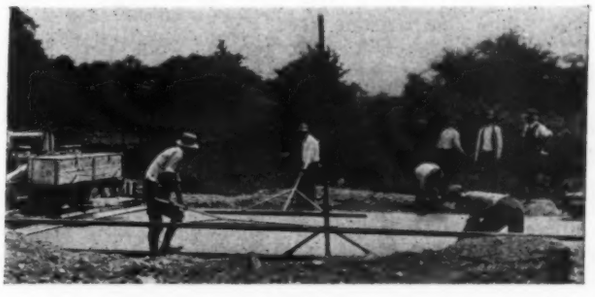
The following tabulation shows the production possibilities of 21E and 27E pavers at 30, 35 and 40 batches per hour on standard Pennsylvania concrete pavements. The difference between a high and low average represents the difference between profit and loss on any particular project.

Linear Feet of Concrete Pavement Which Can Be Laid per Hour, Based on Number of Batches per Hour

One-Course Reinforced Concrete Pavement, One-inch Crown; Volumetric Proportioning

Width and Thickness of Pavement	No. Ft. Laid by 5-bag Batch Batches per Hour 30	35	40	No. Ft. Laid by 6-bag Batch Batches per Hour 30	35	40
16-foot— 8-6- 8	68	79	90	81	95	108
18-foot— 8-6- 8	60	70	80	73	85	97
18-foot— 9-7- 9	52	61	70	63	74	85
18-foot—10-8-10	46	54	62	56	65	74
20-foot— 9-7- 9	47	55	63	57	66	75
20-foot—10-8-10	42	49	56	51	59	67
One-Course Reinforced Concrete Pavement, One-inch Crown; Weight Proportioning						
16-foot— 8-6- 8	70	82	94	84	98	112
18-foot— 8-6- 8	63	73	83	75	87	99
18-foot— 9-7- 9	54	63	72	65	76	87
18-foot—10-8-10	48	56	64	57	67	77
20-foot— 9-7- 9	49	57	65	58	68	78
20-foot—10-8-10	43	50	57	52	61	70

With the exception of breakdowns, practically all items of delay can be eliminated by proper management on the part of the contractors; and breakdowns of any duration can be prevented by keeping a sufficient number and variety of repair parts on hand to met these emergencies. Too much time loss is shown under "All Other Causes" for proper comparison of results. Most of this time represents poor organization on the part of contractor, especially in the finishing unit. Contractors were not permitted to proceed



Shows short space between finishing machine (seen at left) and finishers' bridge (at right) in which finishers are straightedging and correcting any irregularities in surface.

Charged skip being raised. Note that truck has moved just far enough so skip will clear it.

Showing form laid ahead of mixer. Batch trucks waiting to discharge into skip. Subgrade gang 1500 feet ahead.

if straight-edging of finished pavement showed finishers were not sufficiently experienced to secure a good-riding pavement.

During the summer of 1929, under the most perfect weather conditions which we had had in Pennsylvania for several seasons, there was an average of 60 paving mixers in operation, laying an average of 20 miles of pavement per week, or only one-third of a mile per unit. This production was most discouraging, and an efficiency test was conducted during the week from September 15 to September 21, inclusive. The results of this test, by divisions in the States, were as follows:

Efficiency Rating of Paving Contractors on 69 Jobs, September 15 to September 21, Inclusive

	Time Efficiency				Mixer Operating Efficiency			
Division No.	Possible No. Working Hours	Actual No. Working Hours	Per Cent. Efficient	Rating	Possible Number Batches Per Hour	Average Number Batches Per Hour	Per Cent. Efficient	Rating
1	628.50	484.80	77	7	40	23.3	58.25	5
2	336.00	295.00	90	1	40	23.2	58.00	6*
3	259.00	229.70	88.4	2	40	25.5	63.75	3
4	461.00	382.22	83	5	40	24.6	61.50	4
5	633.75	511.59	81	6	40	21.1	52.75	8
6	493.00	340.92	69	8	40	26.1	65.25	2
7	224.00	190.85	85.2	3	40	27.75	69.40	1
8	297.00	247.90	84	4	40	23.20	58.00	6*
State Average	3,332.25	2,682.98	81		40	24.34	60.85	

*Divisions Nos. 2 and 8 tied for sixth place.

The results of this test showed that these contractors utilized an average of 81 per cent of their available working time, and that paving units operated at 60 per cent of maximum efficiency. The contractors knew that this test was being conducted, and utilized slightly more of their time than the average for the year. The comparisons are:

Time Efficiency—Yearly report, 76.4 per cent. Week Sept. 15-21, 81 per cent.

Operating Efficiency—yearly report, 23 batches per hr., 60 per cent efficiency. Week Sept. 15-21, 24.3+ batches per hr. 60 per cent + maximum efficiency.

During the week after this special test was conducted, with seventy pavers operating, we secured a mileage of 31.50 miles or 0.45 mile per unit. This represents an increase of 0.12 mile per unit per week, or an increase of 35 per cent in production over the weekly average of the season up to that time, during the good weather conditions. This proves conclusively what can be accomplished if contractors will study their equipment requirements, material supplies and organizations, with a view to ascertaining their shortcomings and taking the necessary steps to correct them.

Both the yearly and the special test reports emphasize the fact that the only working unit which can be used as a basis of comparison is the number of batches per hour produced by the mixer. The variation in the width and depth of pavement, and the size of the mixer employed, eliminate the lineal foot or the square yard as the unit of comparison. Contractors must quit thinking in terms of footage or yardage and concentrate on batches per hour if real improvement in production is to be secured.

The argument has been advanced that, inasmuch as the average rate of efficiency and production appears to be so fairly uniform, it might not be possible to decrease the time lost or increase the number of batches per hour. A study of the records of the ten contractors who lost the *least* time in 1929 shows that they lost only 4 to 6 per cent of the available working time, and their rate of progress per hour was considerably above the general average of the State. The records of the ten contractors who lost the *most* time showed that these contractors lost from 51 to 75 per cent of the total available working time, and that in most cases their average production per hour was considerably less than the State average. The fact that ten contractors can operate with only 4 to 6 per cent lost time is absolute proof of inefficiency of the others.

To insure continuous operation of a paving unit, the individual contractor must establish, divide and coordinate the following operations which enter into the construction:

1. Plentiful material supply at a properly laid-out proportioning plant.
2. Sufficient equipment to unload, load, and proportion batches.
3. Sufficient number of transporting units to haul batches from plant to mixer.
4. Adequate water supply and sufficient pumping equipment.
5. First class *mixer* and *mixer operator*.
6. Forms and subgrade prepared sufficiently in advance so there will be no delay in paving.
7. Finishing machine in good order and *experienced operator* and *finishers*.

Good equipment, plentiful material supply, and a good organization are very essential to successful business operation. Greater than any of these is management, and the first syllable of management is "man." It is the "man" in the management upon which the success of the direction of the operations must be based. If the contractor can give the job his individual time and effort and is qualified to handle and direct construction work, it is to his best interest to do co. If not, he should secure the most capable man available to handle and direct the organization.

Contractors must realize that concrete paving is a manufacturing operation. Modern industry, through increasingly efficient management, has increased production, improved product, decreased cost and increased earnings. The highway construction paving industry can accomplish the same results if it will decrease the lost motion and take up the slack.

The modern paving mixer is the key to the entire situation. It is the "bottleneck" of production. It can load, mix and discharge only such amounts of finished product as are put through it. A paving mixer in poor condition will wreck any organization, no matter how well the other features of a job may be organized or managed. Even more important than the machine itself is the operator. During the working day he must become actually a part of the machine, to perform certain functions and operations at the exact specified time.

(*Continued on page 64*)

THE EDITOR'S PAGE

Developments in Snow Handling

Modern methods of snow handling are a development of comparatively few years, and have not yet been standardized; and the same is true of the equipment used. It is therefore all the more desirable that those in charge of this work compare notes in order that each may learn of the successes and failures of others, compare them with his own, and thus develop the methods best adapted to his own conditions. For this reason we assemble each year a symposium on snow handling; and do so at this time so that the information offered can be studied before plans are made for next winter, which should be done very soon now if new equipment is to be ordered and delivered before snow flies. Early ordering of equipment is especially desirable this year, to prevent threatened unemployment in the equipment manufacturing industry.

That methods are not yet standardized, and even those which are generally adopted are not universally so, is indicated by descriptions received from snow-handling officials for this year's symposium. Most agree that snow fighting should begin as soon as about two inches of snow has fallen; but one official thinks it less expensive to wait until the storm is over. Many advocate the use of snow fences where drifts are apt to form, but one claims that it is cheaper to remove the snow than to use fences. In both these cases the exceptional practice is apparently dictated by paucity of funds; but one official finds the cost per winter month of maintenance, including keeping the roads clear of snow, less than the monthly cost of summer maintenance.

There seems to be a general agreement that it is advisable to use truck plows which can travel at 25 or 30 miles an hour except where drifts make this impracticable; both because of the greater mileage covered and also because the greater the speed the further to the side the snow is thrown. In most states, on other than city streets, the snow is pushed aside only, although a few rotary plows are used. In the busier city streets, however, it is becoming increasingly common to haul the snow away, many using mechanical loaders for loading the trucks. Other ideas will be noted in reading the articles.

Gambling Specifications

One of the bureaus of the Federal government a few weeks ago called for bids for drilling a well under specifications which are certainly open to criticism. These stated that the exact location of the well would be told the contractor *after* the contract had been awarded; the depth would be not less than 500 feet nor more than 1150 feet; tests would be made every hundred feet to learn at what depth the specified amount—100 g.p.m.—can be obtained: the drilling would be done under the supervision of a representative of the department; payment would be made per foot of depth—*but* "in case it is impossible, *on account of the absence or unsatisfactory character of the water-bearing formation,* to furnish a sufficient quantity of water, the contractor shall be paid at the rate of one-half of the above-mentioned (bid) price per foot drilled."

In other words, the contractor is asked to risk half his bid price on a gamble as to the presence of sufficient water somewhere within 1150 feet of the surface, at a point selected by others after he has signed the contract, and by means of a well sunk under their instructions. There is nothing in the specifications to indicate that the deduction would depend on any act or omission on his part.

The director of the bureau which called for these bids, in reply to our inquiry, said, "We do not have a technical man in our office and therefore rely on other Government agencies for specifications covering technical matters. While the Geological Survey did not prepare this particular specification, the clause quoted was taken from specifications for other wells prepared by the Geological Survey."

Inquiry of the Geological Survey brought the explanation: "The greatest difficulties with respect to contracts relate to wells that obtain their water supplies from deposits of sand and gravel. Under modern methods of constructing these wells, especially where large supplies are required, the time spent in developing the well may be as great as the time spent in drilling the hole, and the results depend very largely on the skill and effort of the driller. The type of contract to which you refer has been recommended by the Geological Survey in two cases for the drilling of wells by the Federal Government in localities where sandy or gravelly beds were known to exist, but where the yield of a well depends largely on the 'finishing" or 'developing.' One of these" was for the bureau in question at a point more than two thousand miles from the well herein under discussion. Moreover, the sentence quoted in the first paragraph "is not properly stated. It should merely read: 'In case the above-mentioned guaranty (as to yield of well) is not fulfilled, the contractor shall be paid at the rate of one-half of the above-mentioned price per foot drilled?"

A clause which was possibly justifiable in a modified form for a particular case is used for work under conditions which are apparently entirely different. As well use medicine prescribed by a physician for a certain case, to treat another patient for an undiagnosed ailment. Specifications for work of an engineering nature should be prepared only by an engineer, and used only for the particular job for which they were prepared.

In the above case, at least one experienced firm of well drillers refused to bid on such a gamble, and it is hoped that there were others. Much has been done by engineers to remove the gambling features from their specifications, and as much as possible of the uncertainty; but it rests with the contractors themselves to secure the universal adoption of the improvements already commonly accepted, and others not yet made, by refusing to bid on objectionable specifications and informing those issuing them of the reasons for their objections.

Institutional Water and Sewage Treatment Plants In New Jersey*

G. M. Ridenour

Research Engineer, Dept. of Sewage Research, New Jersey Agricultural Experiment Station

This article might be considered as the author's contribution to the symposium on the construction and operation of plants at state institutions which resulted from an editorial on the subject in our March issue, comments on which appeared in the May issue and elsewhere in this issue. This general statement of New Jersey's attitude is to be followed by descriptions of some of the plants recently constructed at the institutions of that state.

General Status of Institutional Plants

PUBLIC institutions are multiplying in number and increasing in population throughout the country. These institutions are frequently communities of considerable size, and the problems of water and sewage treatment in connection with them represent points in common with problems of planning treatment for our normal communities, as well as special features which are more difficult to incorporate into good design and operation of plants.

It is unfortunate that in time past this important aspect of proper design and operation of plants has not been given the attention which it deserves, with the result that in many public institutions the design and operation of water and sewage plants do not represent the present-day knowledge of these subjects.

This paper is offered as a description of a program which has been worked out in New Jersey, through the cooperation of the New Jersey State Department of Sewage Research, as a phase of the cooperative activities of the New Jersey Agricultural Experiment Station working in close affiliation with the central supervising agency of the State Charitable and Correctional Institutions.

Fundamental to progress in the field of proper planning of water and sewage plants for public institutions are:

A. The full cordial cooperation on the part of central institutional supervising authorities.

B. The development of facilities and interest on the part of local institution administration.

C. The recognition that, however small or isolated the state institution, proper treatment plants are a vital sanitary project.

D. The recognition that many plants may have been poorly designed or poorly operated, and that competent modern engineering services for design and operation are absolutely essential.

Local Administration—There is perhaps some excuse for the general apathy toward the condition and operation of such a plant on the part of the local institutional administration. The operator in charge is generally overloaded with other projects and duties; the superintendent of the institution and his staff are too busy with their duties to check the operator's facilities to take proper care of the plant and his interest in its performance; or the entire staff lacks sufficient interest in that phase of the institutional duties to care for the protection of their own properties and the right of the people who might use the stream below.

State Administration—On the other hand, there seems to be little excuse for the state passively submitting to this attitude on the part of the institutional administration when it is within the state's powers, privileges or duties to see that adequate plants are provided and these facilities properly supervised. Even in the unusual case of lack of such powers, the potent forces of education and cooperation are still available.

Size and Isolation—In general, the viewpoint is held that an institution, usually consisting of only a few buildings, does not represent a very serious menace in the disposal of its wastes. However, when consideration is given to the concentration of population within those buildings, the types of contagious diseases which may be represented, and often the small size of the receiving stream, the importance of proper treatment facilities comes to the front. For example, the small-appearing group of buildings may house 1,000 patients or inmates; the average sewage flow, usually larger per capita than from a municipality, may vary from 125,000 to 250,000 gallons daily, depending on the type of institution; and this is equivalent to a town of from 1,250 to 2,500 inhabitants. There are many institutions which will double and even treble this. And while the equivalent sewage-flow population is still comparable to only a small town, it is large enough to fall in that classification of towns which are recognized as demanding proper sewage plant facilities, competent engineering supervision and design, and intelligent operation.

The very fact of the general isolation of an institution may be a major factor in its menace to public health. The small stream in quiet, out of the way places, is always popular for picnic parties, bathing and wading by families and school children. Naturally, the majority of streams receiving institutional wastes are of this type.

Engineering Design and Supervision of Operation—In the majority of cases, competent engineering supervision of design and subsequent operation have been seriously lacking. Why good supervision has not been considered to be justified is hard to understand; especially in view of the fact that the design and supervision of these plants present many special features, such as erratic sewage flow conditions, varying strengths of sewage at various institutions, small receiving streams, required nearness of the plant to the buildings, and necessary flexibility for operation and future extension depending upon growth of the insti-

*Journal Series paper of the New Jersey Agricultural Experiment Station, New Brunswick, N. J. Dept. of Sewage Research.

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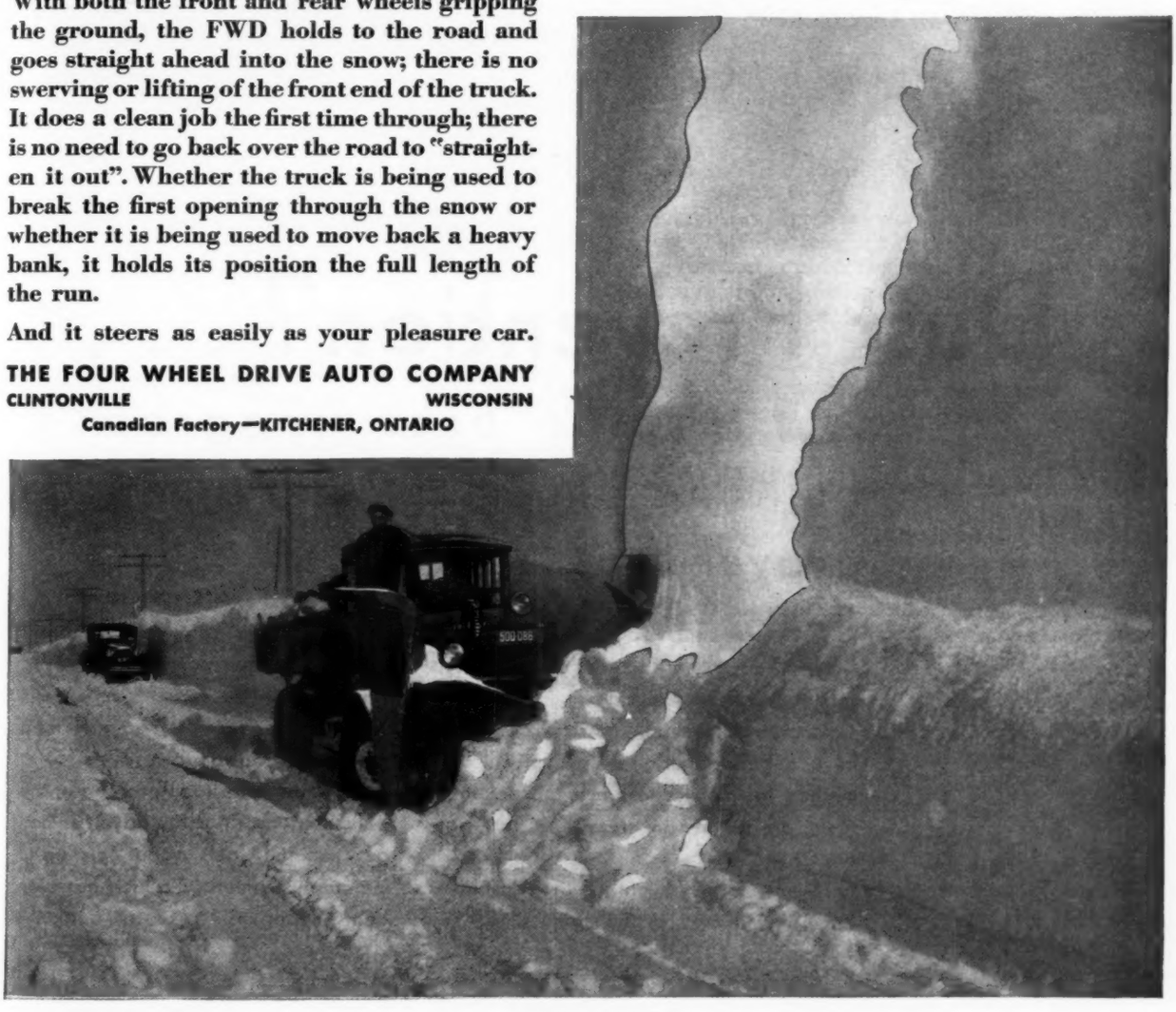

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CONTROLS DUST

tution. Under such conditions, the necessity for this supervision is certainly not finished when the construction program has been completed.

The need for subsequent supervision and control work by a qualified central agency is clear in these cases. The supervision of operation usually falls upon the institutional engineer, who, in addition to this, generally has charge of all other tasks around the institution, varying from chasing birds out of lofts to supervising the power houses. Accordingly, he lacks time for other than casual and physical inspection of the plant performance. Most often he does not have the time, inclination or knowledge to give the plant the control work that it should have. A central control agency which has time, personnel, and facilities available for visiting the plants at regular intervals, running analyses, instructing operators and designing new units when required, is the most logical solution to this problem.

New Jersey's Attitude

The State of New Jersey has realized its responsibility in this respect and rapid strides are being made in placing the state institutional water and sewage plants where they rightfully belong in the field of sanitation. This has been made possible through the constructive attitude and progressive spirit of Mr. Ellis, State Commissioner of Institutions and Agencies, whose department approves all new state institutional projects. Two years ago an arrangement was made whereby the design of new plants, reconstruction and remodeling of old plants, and supervision of operation, were to be performed by the Department of Water Supplies and Sewage Disposal of the New Jersey Agricultural Experiment Station, in cooperation with the State Department of Institutions and Agencies and the State Board of Health.

Program Outlined—The program outlined at that time for the improvement of the New Jersey institutional sanitary facilities was briefly as follows:

1. The improvement of plant structures, which was to be initiated by a general survey of all institutional plants to determine their adequacy. This survey was to be followed by advisable remodeling and extension of plants where existing units could be used, or the design and construction of entirely new plants where needed.

2. Improvement of operation for the purpose of increasing the efficiency of existing plants and thereby forestalling installation of a new plant or units, which would be necessary if the operation remained inefficient.

3. To institute central control work for the purpose of instructing the operator in correct operating methods and laboratory tests; collecting samples for more accurate and complete analysis in the central laboratory; and working out, by intensive field study, any special problems arising at any of the water or sewage plants.

4. To collect data, which are now especially meager on institutional sewage and sewage flow, which would enable the designing and construction of future plants and extensions to be placed on a more economical and accurate basis than had theretofore been possible.

This program was immediately placed in effect by the preliminary survey of the majority of the institutional water and sewage plants.

The Problem Presented

Diversity of Sewage Problems—It was found from this survey that a diversity of sewage problems was represented which would affect both the design of plants and operation requirements. This was brought about by three general factors; first, the wide geographical distribution; second, the varying sizes of the institutions; and third, the varying strengths of sewage and erratic flow conditions. In some ways these factors represented problems in sewage treatment and operation more difficult than those encountered in larger municipal plant design and operation.

Location and Size—The locations of the institutions, sixteen in number, vary from hills with impervious clay soil to the flat, extremely sandy regions along the Atlantic coast.

The sizes of the institutions vary from populations of 500 with an average sewage flow of 50,000 gallons daily, to 5,000 with a flow of approximately 1,000,000 gallons daily. Thus, in quantity of sewage flow the institutions represent projects corresponding from hamlets of 500 population to towns of 10,000.

Sewage—The character of sewage varies from very dilute sewage to that of medium strength. In one plant, dye wastes are present from a dyeing industry within the institution. At most plants the sewage contains a high per cent of grease. At all plants the sawage is fresh when it enters, due to the comparatively short distance of travel.

The sewage flow at all plants varies from practically zero flow for several hours during the night to about three peak flows during the day. These peak rates may be as high as three or four times the average flow. This characteristic is perhaps the hardest of any to correlate into economical design and proper operation of the institutional plants.

Diversity of Water Supply Problems—The problems in water supplies were equally as broad. With the exception of one institution, which has a filtered supply, the water is taken from deep wells. However, those supplies represent waters of several different types and treatment requirements.

In the coastal region, the water is of a very corrosive nature due to dissolved carbonic acid. In a more centrally located region, the water is less corrosive but contains iron in sufficient amounts to cause red water in the pipe mains. In another region, the water is of considerable hardness (scale forming), yet corrosive due to a high mineral acid content. And in the higher regions of the western part of the state, the well water is non-corrosive but of high hardness due to dissolved limestone.

These varying water conditions are of particular significance from the standpoint of proper treatment, since all institutions have central power plants for power production, steam heating, laundry and other hot water purposes.

Improvements Effected

Plant Improvement—The survey and study of institutional conditions showed the necessity for immediate improvement of five out of the then existing twelve sewage plants by remodeling or extension of the treatment processes and the installation of five processes for treatment of water, mainly for corrosion of hot water systems and boilers. The design and construction of these were immediately started, and have been completed with the exception of two plants, which will be completed within a short time. In the meantime, construction on four new institutions has been started and the design and construction of entirely new sewage plants are under way for these. This will make a total of nine sewage plants placed on an up-to-date basis within another year, and six installations for water treatment, including a complete remodeling for the one water filtration plant.

(*Continued on page 72*)

Public Works of Holland, Michigan

Brief description of the operations of the Board of Public Works during the year 1929, which has control of the water works, electric light and power, and sewerage systems. Liming Imhoff tanks.

THE city charter of Holland, Michigan, provides for a Board of Public Works whose duties, powers and responsibilities include the construction, management, supervision, and control of the city's water works and electric light and power system, and the management and supervision of a sanitary sewer system and a fire alarm telegraph system. From the unusually clear and concise statement of this Board for the year 1929, we select the following information as being of more or less general interest.

Generally speaking, all extensions to the various distribution systems are done by day labor, except only when the class of work requires a large outlay for construction equipment. Electric line extensions are financed out of earnings, as are water main extensions when justified. Otherwise, a portion of the cost of the water main is assessed against the adjacent properties. Of the cost of constructing lateral sewers, 5/6 is assessed against the adjacent property owners, and 1/6 is paid out of the main sewer fund. Where a sewer larger than 8 in. would be required, the extra expense also is paid from the main sewer fund. This fund also provides the money necessary for operating the collection system and the disposal plant. It is provided by the council annually on the basis of the estimate by the board of the amount needed.

There are approximately 45 full-time employees in all of the departments, with a few part-time employees for special work. The payroll for 1929 approximated $70,000.

The Water Plant

The domestic supply is obtained from sand and gravel strata at three pumping stations, the pumps being motor driven. A fourth pumping station contains a steam pump which draws water from a 1,000,000-gallon covered concrete reservoir to meet the peak load during the day; whatever is pumped out during the day being replaced the following night. Records for last year show that the reservoir was used on six days in June, 17 days in July, 17 in August, and 6 in September. The maximum amount of water withdrawn on any one day was 454,000 gallons. Without the presence of this reservoir from which to draw during such periods, it would have been impossible to maintain adequate pressure in the distribution system.

The pumping during the four months from June to September inclusive totalled greater than in any previous year, it having been 251,809,000 gallons. (The population of Holland is about 17,000). The maximum monthly pumpage was in July, when the total reached 79,746,000 gallons. The maximum amount pumped in any one day was 4,014,400 gallons. The maximum peak load sustained for one hour exceeded a rate of 7,000,000 gallons per day. The pressure was maintained at approximately 50 pounds during the season, although it was necessary to draw upon the reservoir, as stated above, in order to maintain this pressure.

Last year, the impending paving of a street in which a 4-inch main was used was taken as an opportunity for replacing this with a larger pipe. The Park Board, however, suggested that the 4-inch main be left in the ground and used to supply the parks fronting on this street with water from a lake, which water would be warmer than that supplied by the water works and would be better for sprinkling purposes; in addition to which it would conserve the public supply. This was done, this 4-inch line being entirely disconnected from all of the rest of the system and a pump installed at the lake to force lake water through it. The Board financed the improvement, costing $5,018, and the Park Board will pay it a sum agreed upon to cover the operation, maintenance, and overhead cost of the system.

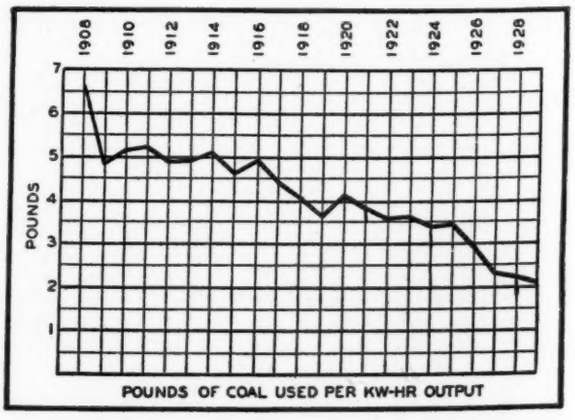
Electrical Plant

The Board operates one steam electric plant, with a total capacity of 5000 kilowatts. There are three boilers, two of which can furnish sufficient capacity up to 4000 k.w., leaving the third for a standby. Ashes are discharged into an adjacent swamp by means of a water sluiceway.

Two years ago the Board entered into an agreement with the Bell Telephone Company, by which the city poles and the Telephone Co.'s poles are used jointly by both, each paying rent for the use of pole space on the other's poles. This permitted the removal of about 280 poles, much to the improvement of the appearance of the street.

The accompanying diagram shows the great economy in the use of coal since the beginning of the plant. At that time something over 6½ lbs. of coal per k.w.h. output was used; which has been decreasing uniformly until last year only a little over 2 lbs. per k.w.h. was required.

The total revenue from the electric plant last year was $297,825, the operating expenses were $103,726, while depreciation was charged at $45,357 and taxes at $17,967; giving a total expense of $167,050 and a net income of $130,775. Every service is metered, and no free service is given to any individual or public department. The department paid $4,418 city tax, $6,241 school tax, and makes contributions to several city departments, last year having paid $24,689 of the



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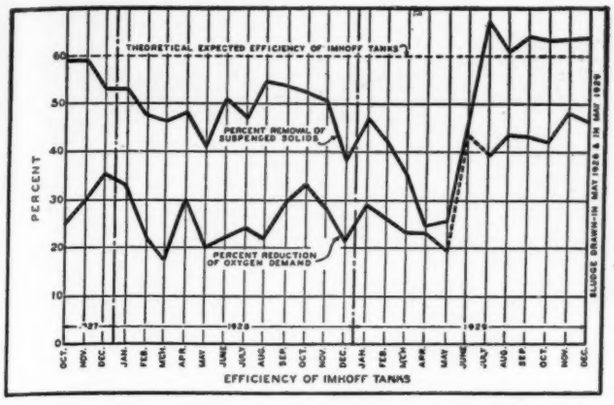


Reduction of oxygen demand and suspended solids in Imhoff Tank.

city's debts, and $62,183 towards the Holland Hospital; a total of $86,872. During the past six years it has paid an average of $30,137 per year of the city debt, which has diminished the city tax burden at an average rate of $1.78 per $1000 of assessed valuation.

Sewerage System

The city is sewered on the separate system, the storm water system being under the direct supervision of the city engineer. The sanitary sewers are ventilated at each property from the sewer directly through a 4-inch ventilating stack to the air above the roof. Prior to 1918, the joints of the vitrified clay pipes were made of cement; but since that time the joints have been made with a bituminous compound, poured hot. Many of the cement joints are now leaking, and allow considerable infiltration of ground water and sand; removal of the latter having cost $1,329 last year.

The sewers are flushed periodically throughout the year. A 2-inch water service is laid to the manhole at the upper end of each lateral sewer, and the sewer is flushed by opening a 2-inch valve by means of a long-handled key from the street surface; the water being allowed to run generally 20 or 30 minutes, depending upon the condition of the sewer.

Last year saw a marked improvement in the operation of the sewage treatment plant, which consists of Imhoff tanks and sludge beds. Nearness of the plant to residences and to a Federal highway makes it desirable to reduce odors to a minimum. During 1928 there were some complaints concerning odors, especially during drawing of sludge. At that time, tanks were in acid condition and sludge was not ripening properly. Only 400 cu. yds. of sludge were drawn and proved to be poorly digested. The 1928 report called attention to the fact that the abnormally large amount of garbage present in the local sewage was probably the cause of foaming and of odors.

Addition of lime to tanks was begun in March, 1928. At first lime was added as a corrective—to destroy volatile acids producing odors—in accordance with Rudolf's report.* However, by April 14, 1928, the neutral point (pH = 7.0) had been passed and it was still necessary to continue liming. During May lime was added in accordance with Fair & Carlson's report.** According to Fair and Carlson, if a tank is limed to a pH of 8.0, it will digest well without further addition of lime and reduce the digestion period by one half. By the end of July conditions did not seem to have improved a great deal and it seemed necessary, as in so many plants, to continue the liming indefinitely, once begun.

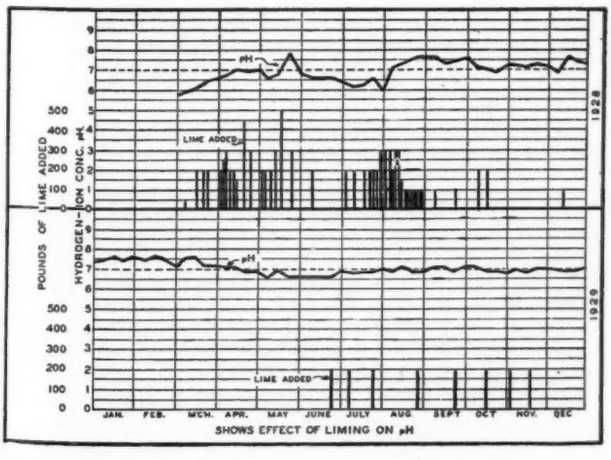
By liming sufficiently during August and part of September, 1928, to keep the pH well above the neutral point for more than a month, we hoped to establish the optimum reaction for desirable bacteria and to discourage the growth of those bacteria responsible for the production of volatile acids. Results seem to prove the guess to be correct since whereas, during the six months, March-August, 1928, inclusive, approximately 7500 lbs. of lime were used per tank, in the next sixteen months only 2300 lbs. have been added per tank.

During acid condition of tanks it was necessary to retain the accumulated sludge in digestion chambers to a level where good removal was hardly possible. This was necessary till good digestion had been established. With the coming of warm weather, May, 1929 sludge was drawn and drawings were continued throughout the summer. 2200 cu. yds. of well digested sludge were drawn during the summer. Subsequent to drawing sludge, the per cent removal of suspended solids has risen to a level higher than the theoretical expected value for Imhoff tanks.

During 1929 a prechlorinator was installed and put into operation to help cut down odors. It has been found that prechlorination during the late afternoon and evening is sufficient to keep down odors about the plant. The relative value of proper digestion and prechlorination in controlling odors should be studied with a view to bringing prechlorination down to a minimum. There should be prechlorination for short periods in any event, to prevent flies and mosquitoes from hatching in the tanks.

During the past year, then,

1. Odors have been practically eliminated
   a—By establishing proper digestion;
   b—By prechlorination.
2. Digestion period has been shortened by ½ to 2/3.
3. Liming is necessary only occasionally and then in small amounts.
4. Efficiency of Imhoff tanks (per cent removal of suspended solids and per cent reduction of oxygen demand) have been boosted above normal values.
5. Prechlorination has cut down odors at the pumping station and possibly in the flowing through compartments and has kept flies and mosquitoes from breeding in tanks.



Effect of liming on Hydrogen Ion Concentration

*Rudolfs', Willem "Report of New Jersey Agric. Exper. Station," 1927.

**Fair and Carlson in Engineering News-Record of Dec. 7, 1927.

Welded Iron Pipe for Detroit Water Works

By R. C. Beam
Development Engineer, American Rolling Mill Co.

ON May 8, 1929, the Detroit Board of Water Commissioners received proposals for furnishing and laying 9300 feet of water pipe 54″ diameter, to be either lock bar, hammer welded, electrically welded, or riveted construction. The bids submitted were evaluated on the basis of estimated service life, and in order to fairly evaluate the Armco ingot iron and steel bids, the Board of Water Commissioners, through its engineers, assigned to steel pipe a life of 35 years (which is the minimum life as given in the manual of the American Water Works Association) and to ingot iron, an additional life of 10 years, or 45 years. On May 16, 1929, the contract for furnishing and laying this pipe line was awarded to Julius Porrath & Son, Detroit, Michigan. Pipe fabricated by the United Welding Company, Middletown, Ohio, made of Armco ingot iron plates ½″ x 122″ x 173¼″ in size, was approved by the Department of Water Supply on May 22.

An unusual design, unique in welded pipe construction, was employed by the fabricators of this line. The pipe was delivered in 40 foot lengths, 33 1/3% longer than standard, each length made of four plates. In 9300 linear feet of pipe, this increase of 10 feet per section reduced the number of field joints from 310 to 233.

Although of welded construction, the pipe was fabricated like the old-fashioned riveted mains. Plates of pure iron ¼″ thick and 122″ wide were rolled so that one plate went entirely around, forming a complete ring of pipe. Four of these rings were lap-welded in the shop, making a length of pipe 40 feet long. This is the first time such design has ever been used on a large welded transmission line. Fifteen hundred tons of plates were required to fabricate the 9300 feet of line.

The circular seams lapped approximately 1½ inches, and were welded inside and out, while the longitudinal seams were butt welded. Taper rings were used throughout each section of the pipe. The field joints also were designed to use tapered sections.

Before any section was shipped, it was carefully tested for tightness, the surface thoroughly cleaned, and then dipped in a protective coating.

The combination of the old design and its new application gives a pipe that is unusually stiff because of the lap-welded circular joints. This makes it possible to place this pipe under deep fills without angle reinforcing rings. Another inherent advantage is the fact that plate metal pipe is not subject to sudden breaks which cause serious interruption to service and great damage to streets and adjacent property.

A forty-foot section assembled for welding into a single section.

Forty-foot sections of pipe distributed along the line. At right, trench being excavated.

On November 13, 1929, bids were received on 9000 feet of 66-inch pipe, and contract awarded for the same material and design as used for the 54-inch pipe.

Sewage Treatment Plants at State Institutions

THE editorial in our March issue suggesting that sewage treatment plants at state institutions should be so designed and operated as to serve as models for the municipalities of the state, and might well be used for experimental purposes also, has been commented upon as follows by H. E. Miller, chief engineer of the North Carolina State Board of Health in a letter to the editor:

We feel with the editor that state institution plants should represent the best practice throughout, and should be in keeping with the full needs of the situation. All too often in the past, state institutions have exercised their privilege as an agency exempt from suits, with the complete disregard of the health and interests of other persons. State institution sewage plants, also water plants, have for the most part been installed without any rhyme or reason, and all too often the institution management, with an exaggerated sense of responsibility to those state control agencies (since the institution is a part of the state itself), has proceeded with the installation of the plants that resulted in extensive wastes of public funds and the setting up of a poor example for municipalities and other agencies controlled by the state to follow.

Beginning a few years ago, the assistance of this department was sought in an increasing extent by the Governor and the Budget Bureau (the Governor is also director of the budget), until finally the Bureau of Engineering of the State Board of Health has become the agency charged with the responsibility for the design, supervision of construction, and the control of the supervision of operation of state institution water and sewage plants. It is now possible, therefore, to have state institution plants properly constructed and properly operated.

There are some difficulties in connection with the utilization of state institution plants for experimentation. One is the matter of general applicability of results, since all state institution plans treat exclusively domestic wastes. Conclusions drawn from treatment results handling such sewage would have more or less limited application when applied to municipal sewage involving various industrial wastes.

Furthermore, if the State Board of Health were to conduct experiments at institutional disposal plants, it would usually be necessary for the State Board of Health to entirely finance the cost of such experiments, since it would be difficult to make the institution see the possibility of the experiments being any material advantage to the institution. In the case of municipalities, however, there is usually sufficient possibility of economic advantage to the municipalty from the utilization of experimental results as to encourage financial participation.

I am pleased to observe, however, that you have opened the subject for discussion through your editorial page. I hope that it will meet with a generous response.

Ideas expressed by officials of other state health boards were published in the May issue. Several of them have stated that they have the same ideas on the subject expressed above by Mr. Miller.

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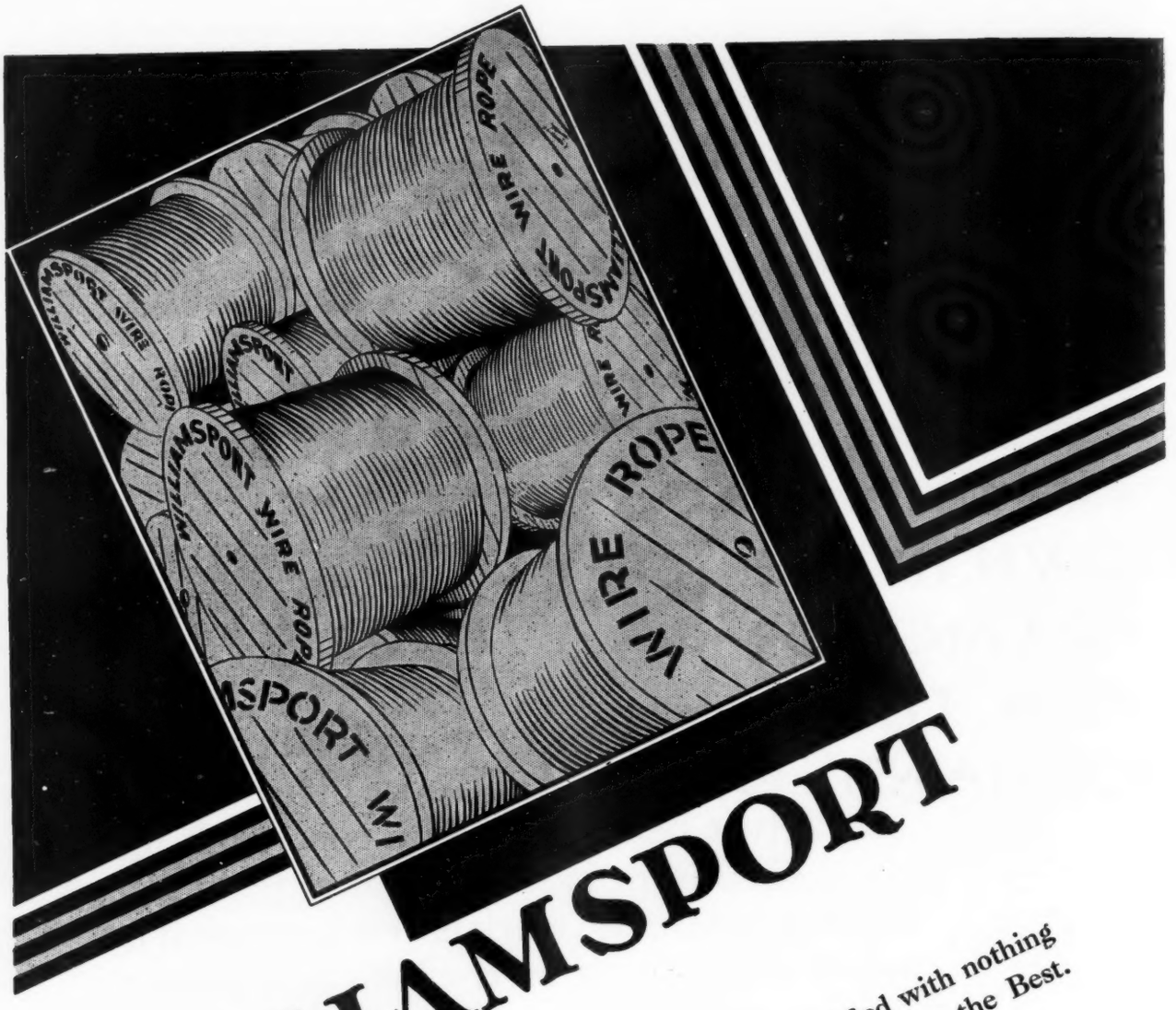

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THE STANDARDS of highway location and design have, during the past three years, shown a remarkable nation-wide improvement. The engineers of the California Division of Highways are making every effort to keep their locations in line with modern practice and to insure that the service furnished will be immediate as well as permanent.

Several of the more important recent improvements in California state highway design practice are described briefly in the following paragraphs:

Permanent Location.—New roads and most major improvements of existing roads are located as nearly as can possibly be foreseen on permanent alignment and grade, which will not require future alteration or correction with consequent loss of a portion of the initial investment; and which, at the same time, is readily adapted to normal growth by widening as required by increasing traffic. In some few cases, new roads or improvements of existing roads are located and designed purposely for temporary rather than for ultimate service, but in such cases consideration is given the ultimate requirement with a view to realizing the maximum salvage value from the temporary road, when the ultimate construction is undertaken.

Curvature Standards.—Curvature on main trunk highways, in all except the most rugged country, is now usually designed to handle safely, vehicles operating at the maximum speed permitted by law. Even in the mountainous regions, 300 feet is regarded as the minimum acceptable curve radius. A properly designed curve of this radius will allow safely a speed of about 40 miles per hour. On a few secondary roads in unusually difficult country, carrying mainly recreational traffic, 200-foot radius curves are used sparingly to keep grading costs within reason.

These curvature standards present a striking contrast to the standards of a few years ago, when 100-foot radius curves were common on trunk roads and 35 miles per hour was considered maximum high speed. It may be stated without exaggeration that our primary trunk roads are being constructed or reconstructed in some cases on curvature standards which are comparable to the curvature standards of main line railroads in adjacent or similar locations.

Curve Superelevation. — Superelevation standards have been revised during the past year to accommodate higher speeds. The superelevation as applied to new projects is designed to make practically all curves within the range of Division of Highway engineering practice safe for speeds of 40 miles per hour or faster.

Curve Widening.—During the past year widening of all curves of 500 feet radius or shorter has been made standard practice. This provides greater clearance between cars passing on curves, increases sight distance around curves, and is so designed that the transition between unwidened straight road and widened curves produces the effect of tapered ends to the curves, aiding greatly in the ease and comfort with which a curve is entered or left, especially at high speeds.

Grade Improvements.—The present tendency is toward the use of 5 per cent maximum grades, especially in the higher altitudes, in response to the popular demand for fast high-gear roads. Six per cent grades are losing favor even on secondary roads, especially where the maximum grade is sustained for a considerable distance. Seven per cent grades are used only in exceptional cases, usually to avoid great loss of distance.

The old practice of rolling grades heavily to reduce cut and fill costs is practically obsolete. On all new work effort is made to secure straight, even grades as an aid to safety, visibility and appearance. In many cases, especially on side-hill mountain and canyon locations, skillful engineering can secure the straight grades for no greater cost than the objectionable rolling grades.

Numerous technical refinements have been made in the detail design and coordination of grades, vertical curves, and horizontal curves, all tending toward greater safety and more pleasing appearance, usually without increased cost.

Visibility on Summits.—Current design requires that at summits on straight roads, objects five feet above the road surface shall be mutually visible to each other for a distance not less than 600 feet. The tendency is to increase this minimum sight distance requirement to 800 feet on important roads. Until quite recently 300 or 400 feet of sight distance was considered ample in California. This vertical sight distance is modified on curves, but is so designed as to be always greater than the horizontal sight allowed by the curve regardless of future widening.

Roadbed Widths.—Pavement widths of 16 feet or less are obsolete. A very few 18-foot temporary surfaces (usually gravel or crushed rock) are being constructed on certain secondary roads in mountainous country when traffic is light. A minimum 20-foot pavement width and a minimum 10-foot traffic lane width have been adopted recently for all permanent and for most temporary or stage pavements.

Shoulder width standards have increased rapidly until the 8-foot parking shoulder on each side of the surfacing is now standard practice on the average trunk road in contrast to the usual two- or three-foot shoulders of several years ago.

Right of Way Widths.—Until recently most state highway rights of way were from 40 to 60 feet wide. Current California state practice, adopted within the last two years, requires a minimum right of way of 80 to 100 feet, depending on the importance and position of the road. In built-up or suburban districts, definite set-back lines for property improvements are usually obtained in connection with right of way agreements, to accommodate future highway growth without excessive expense due to moving buildings, etc. In National Forest lands, arrangements have been made with the Forest Service whereby leases and building permits issued for use of forest lands are restricted by set-back lines at least 100 feet from the center line of state highways.

*By C. H. Purcell, State Highway Engineer, in "California Highways and Public Works."

Utilization of Right of Way.—Considerable effort has been made recently to design typical standard roadway cross sections for various types of roads in order to secure a more efficient use of the right of way. For use on important roads in easy valley locations, a so-called "turnpike" section has been developed which consists essentially of a normal roadbed with wide, gentle side slopes extending to side ditches placed near the right of way lines. The side slopes are so designed that they will fit ultimate widening of the pavement, and at the same time will provide the most efficient distribution of all cut and fill material for both current and ultimate construction. Deep side borrow ditches are avoided, and the slopes are designed so that future improvement will be a continuation of the initial work rather than an alteration.

Provision for roadside trees, sidewalk space, curbs, public utilities equipment, building lines, etc., is included in the typical section designs which have been applied successfully to recent construction.

Pavement Construction Improvement.—The last few years have seen a notable improvement in the strength, durability, and riding qualities of state highway pavements. Concrete pavements have been not only thickened but are now designed scientifically with reinforcement, variable section, etc., in a manner similar to that in which any other type of structural member, beam, or otherwise is designed to resist the stresses and strains of service. Greater unit strengths in concrete are being obtained than ever before. All other types of pavement, including even the low type temporary gravel or crushed rock, are laid with the utmost scientific care in selection of materials, placing, etc., to insure smooth, durable surfaces.

The importance of suitable subgrade and drainage is realized fully.

The design of this factor is considered to be as important fundamentally as the design of the pavement itself, and is now given its full share of consideration.

Practically all important paved state highways are being divided by plainly visible white traffic stripes into well defined traffic lanes. This work was started about a year ago and is being pushed toward completion as rapidly as possible.

Grade Crossing Elimination.—This work is being pushed forward as fast as funds become available therefor.

Drainage.—Although the importance of this factor always has been recognized, it is being given increased attention in connection not only with the disposal of surface drainage but also in connection with subgrade pavement foundations and appearance. In flat country, deep parallel side borrow ditches, such as were often in times past designed to supply material for roadway fills, are no longer permitted as they are considered unsightly, unhealthful in that they often hold stagnant water and breed mosquitoes, and are dangerous. During the past two or three years, many such ditches have been backfilled and eliminated, often in connection with shoulder widening.

Landscaping.—Increasing attention is being paid to this factor of design, especially on recreational roads. Engineers of the Division of Highways are trained to give special attention to the aesthetics of highway design and to avoid wherever practically possible destruction or injury of trees, streams, parking sites, and all types of scenery and natural or cultivated beauty.

Roadside tree planting is encouraged, the state usually assuming responsibility for the care but not the planting of the trees.

Especial attention is given during both location and construction to the development of wide shoulder parking sites at points where good views may be obtained.

Joint Highway Districts.—One of the most important recent trends has been the development of the joint highway district. In line with certain requirements prescribed by law, two or more counties may form a joint highway district to construct an important road, and may request and, subject to the state's approval, may receive state aid in the form of financial contributions and engineering advice. This naturally leads toward higher standards of construction and better coordination of the county road systems.

The preceding notes present only a few of the more important improvements in the trend of modern highway design. It may be stated briefly that the current policy of the California Division of Highways is the production of highways which will at all times provide to the public the fullest measure of transportation service and satisfaction.

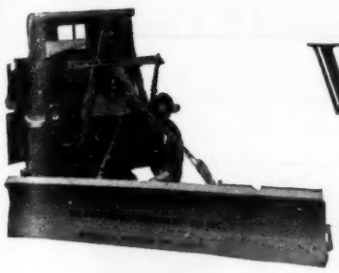
Sewage Treatment Plants Require Competent Operators

A modern water or sewage purification plant requires competent local supervision. Without it such an installation becomes worse than useless because a false sense of security is engendered among those whose health may depend upon an uninfected effluent.

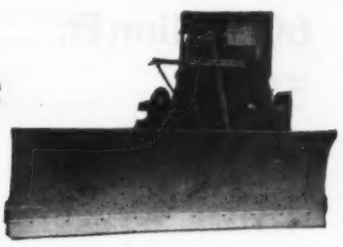
An instance where officials of a town in northwestern New York apparently expected a sewage treatment plant to operate automatically, recently came to light during an inspection by members of the Division of Sanitation of the New York State Department of Health. The plant was constructed in conformity with approved plans, and consists of a pumping station, Imhoff tank, glass covered sludge drying bed, two trickling filter units, chlorinator, and combined secondary and chlorine reaction tank.

One man had charge of the pump in the booster station and the main pumping station and disposal plant. His attention had been concentrated upon maintaining operation of the pumping station because failure of the air pressure controls at this point had resulted in sewage backing into several cellars in the vicinity. The treatment plant was consequently neglected and the situation further aggravated by the freezing of the pipes which damaged them to a considerable degree. In order to relieve the main sewer to the plant, a hole had been made in a manhole located at the creek into which the effluent empties. From this opening, which was about eighteen inches in diameter, raw sewage was flowing into the stream. The glass covered sludge bed had been used as a green house by the operator who evidently had done a flourishing business in tomato plants. There was only about one-half inch of sludge present, probably the original application. The Imhoff tank showed signs of not having been in operation for some time. The chlorinator had not been in use for a long period and the worker in charge had no knowledge whatever concerning its mechanism and never realized that the tanks should be changed when empty.

It was apparent that the neglected and unsatisfactory condition of this sewage treatment plant was due more to a lack of knowledge as to how such plants should be operated than to wilful neglect, inasmuch as immediate steps were taken by the municipal officials to correct the situation as soon as the matter was called to their attention.



We won't be "snowed in" this winter



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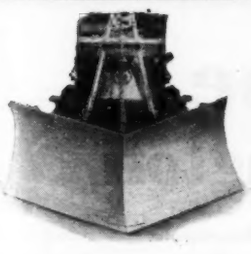

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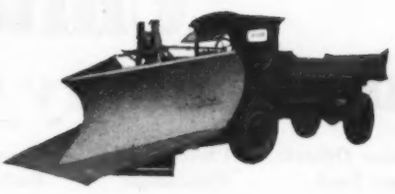
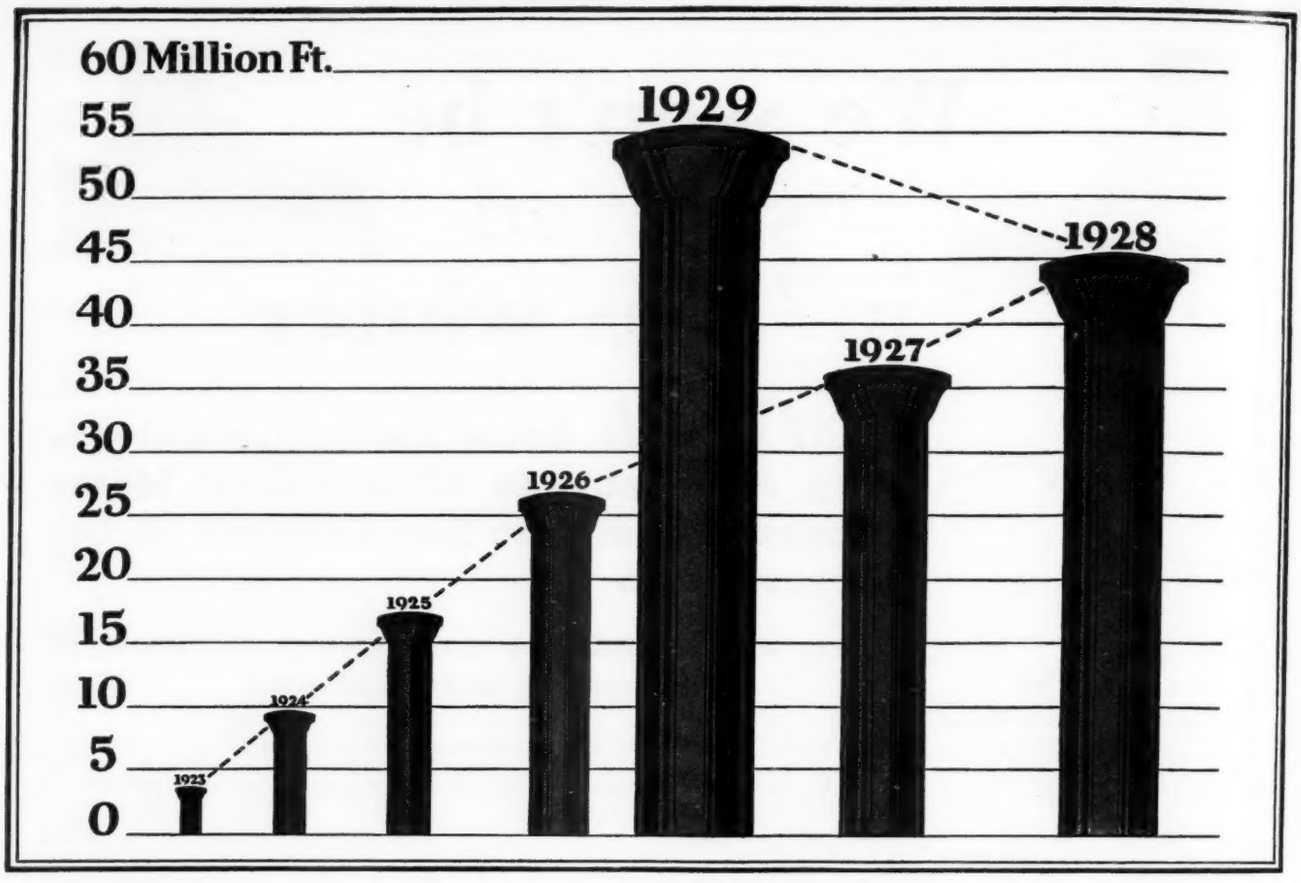


The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93



. . . *today*, more than 10,227 miles of U.S. deLavaud Pipe are in service

In December 1929, more than 54 million feet, or 10,227 miles of deLavaud Pipe — manufactured by the U. S. Pipe and Foundry Company — were in service throughout the country. A mighty fine record of acceptance for this sturdy seven-year-old product!

The first year of its manufacture in the United States, more than three million feet of deLavaud Pipe were put down. Since that time, its popularity has increased by leaps and bounds. The above chart tells the story.

Strength, flexibility and greater carrying capacity are the outstanding reasons for deLavaud Pipe's wide acceptance. DeLavaud Pipe is produced by pouring molten iron into a rapidly revolving metal mold. Centrifugal force holds the metal against the sides of the mold and drives out impurities with a force many times greater than gravity. The metal mold is encased in a water jacket, the cooling action of which brings about the remarkably fine granular structure of the iron.

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Hinton's Municipal Bulletin

We have received a copy of the May tenth issue of the bulletin prepared by Hume K. Nowlan, city manager of Hinton, W. Va., which we believe to be unusual in several respects.

It is in the form of a report addressed to "the Councilmen of the city of Hinton" but we suppose is really intended to inform all the citizens of the recent doings of their officials. It is duplicated from six type-written sheets, four of them illustrated with drawings presumably by Mr. Nowlan or one of his assistants, which serve to lighten the pages. The illustration serving as a heading to the report is reproduced herewith, and one illustrating the announcement that Mayor Meadows expected to assign the week of May 19-24 to the annual clean-up campaign.

In addition to official doings and the financial statement for the previous month, suggestions and general information are given in this bulletin, such as the following, which will interest many outside of Hinton.

CITY
of
HINTON
West Virginia
Office of the City Manager
May the tenth Nineteen thirty
The next regular meeting of the Council will occur in this office Tuesday evening May 13th. at 8: p.m. The change in time from 7:30 to 8: o'clock is in accordance with the Charter, which takes cognizance of the long daylight hours during the summer months.
Clean Up!

Cuts (reduced one-half) used to illustrate the Hinton Bulletin.

SALVAGE

The possibility of making a profit from the salvage of municipal wastes has always intrigued me. The urge to actually investigate this possibility became so strong last month that I made a trip to Baltimore and made a study of the process in effect there. My conclusion is that an enormous investment in plant and equipment would be necessary to make city waste disposal actually self-supporting, much less profitable.

The investigation made, supported by articles covering the same subject in other parts of the United States, does convince me, however, that some salvage operations are highly desirable and entirely feasible even in a city the size of Hinton. In fact the following estimate of returns is based on the possibilities offered by our city:

Estimate of annual recoverable values possible through salvage of municipal wastes.

35 tons Newsprint paper (baled	$204.40
41 tons Scrap iron (cut)	410.00
30 tons Waste paper (baled)	90.00
5 tons Rags-burlap (rolled)	17.00
14 tons Broken glass (boxed)	50.40
50 tons Tin cans (baled)	80.00
10¾ M Bottles (cased)	80.61
	$932.41

To make this recovery it would be necessary to buy a pair of alligator power shears, two baling presses, and erect a sorting trough and storage bins at the incinerator. Prisoners unable to perform heavy work, or truculent prisoners could be used for the sorting and most of the salvage operations. Such prisoners could be safely secured at their stations if necessary, and no guards would be required to prevent their escape.

The economic justification for this salvaging would be unimpressive for the first two years, but thereafter the results would be of material benefit in many self-evident ways. The project is highly recommended for inclusion in the 1930-31 program.

Truck Operating Statistics

Amount of gas and oil used, length of haul and other data furnished by 435 truck users.

Last Fall the General Motors Truck Company sent a questionnaire to truck owners throughout the country and received replies from 7,978 truck users, of which 5,584 were sufficiently complete to be tabulated. Answers were received from all states, from large and small cities and towns, and from owners of trucks numbering only one or two up to great fleets.

These questionnaires were divided into thirty-five classes of users, the largest number of users in any

Averages of Figures Reported by 435 Truck Users

	General Contractors	Road Contractors	Municipal, Co. & State	Gas, Electric & Wat. Util.	All Replies
Number of firms reporting	165	83	57	130	5,584
Total number of light duty (½ to 1½ ton) trucks	475	490	433	2,163	26,656
" " " medium duty (1½ to 3 ton) trucks	317	946	366	1,281	14,504
" " " heavy duty (3½ tons and up) trucks	201	665	415	231	4,857
Miles per gallon of gas, light duty	13.1	11.9	12.0	12.9	13.0
" " " " " medium duty	9.2	7.8	7.6	8.3	9.8
" " " " " heavy duty	6.8	5.8	4.6	4.5	5.7
Miles per quart of oil, light duty	101.6	106.0	98.3	121.6	109.2
" " " " " medium duty	101.8	86.6	83.8	88.4	95.2
" " " " " heavy duty	60.5	79.7	41.7	54.2	56.7
Average pay load, pounds, light duty	2,538	5,311	2,429	1,590	2,396
" " " " medium duty	6,528	7,068	5,662	3,897	5,230
" " " " heavy duty	10,583	10,955	9,429	10,938	11,256
Average length of haul or route, miles, light duty	14.3	9.4	26.1	27.1	29.8
" " " " " " " medium duty	16.7	17.5	36.5	23.4	41.4
" " " " " " " heavy duty	17.6	11.2	18.6	28.2	38.9
Average number of stops per day, light duty	21.2	34.3	26.6	36.5	43.5
" " " " " " medium duty	21.1	38.2	....	23.0	26.5
" " " " " " heavy duty	29.7	32.4	....	20.8	17.3
Total truck operating cost, including maintenance and depreciation, per mile light duty	10.9 cts.	9.6	8.9	8.9	11.6
medium duty	18.4 cts	16.3	15.8	17.4	17.1
heavy duty	37.0 cts.	18.0	20.4	29.0	28.8
Percent doing all their hauling with their own trucks.	50	58	64	55	59

one class being 341 dealers in groceries and other food products; although the greatest number of trucks, 3,763, is found in the classification "Oils and Gasoline," under which 322 firms are listed.

Of most importance to our readers are the four classifications, "General Contractors," "Road Contractors," "Municipal, County and State," and "Gas, Electric and Water Utilities." The replies under these four classifications are presented herewith, tabulated for comparison. These four comprise but 7.8% of all those replying, but own 31% of the heavy-duty trucks. The average road contractor owns nearly ten times as many heavy-duty trucks as the average of all users. The length of haul of road contractors' trucks averages only about one-third the average for all classes combined, and the number of stops per day is much greater; but their operating costs are much less per mile—less than two-thirds as great for heavy-duty trucks.

Old Concrete for Improving Streets

Concrete, stone and brick waste from building operations and street repairs crushed for consolidating soft soil in unpaved streets.

There are in New Orleans 315 miles of paved streets, which is being increased at the rate of about 25 miles a year. There still remains, however, more than 500 miles of unpaved streets in regular use. In his annual report J. L. Reilly, deputy commissioner of public works, says:

"Owing to the very poor natural drainage conditions in the city and the fact that the supporting power of the soil is practically nothing when wet, the use of our unimproved streets by automobiles in any but dry weather is practically impossible unless the streets have been surfaced with such material as gravel, shells, cinders or broken concrete. Of recent years some of this work has been done by contractors at the expense of the property owners, and in such cases the maintenance of these unpaved streets has been materially facilitated.

Hundreds of miles, however, have been improved from year to year by the Division of Public Works, using such materials as old asphalt, concrete brickbats, etc., usually the waste of building operations and street repairs, and which were acquired without any other cost than that of handling. In many instances streets have been repaired with very large pieces of concrete without regard to proper contour, consequently the use of any grading machinery on such streets is out of the question. For the past three years approximately all of the materials used have been first sent through jaw crushers, so that the fineness permits of more satisfactory placing of the material as well as making it possible to finish the surface in a more approved manner.

The use of gravel, shells or other prepared material has been limited to instances where property owners defray the cost of the material required. The funds allotted to the division have not been sufficient to provide a supply of street repair materials and only in instances where service to public institutions was involved or special emergencies, such as preparing streets for funerals when other materials were not available, has the division purchased street repair materials for this work.

The organization looking after the unpaved streets consist of two divisions, each having approximately equal areas to maintain. A superintendent with several regular crews is in charge of each district. Besides placing street repair material, the work also includes the digging and cleaning of ditches along the roadsides, building of plank crossings and culverts at street intersections and, during the summer months, the cutting of grass.

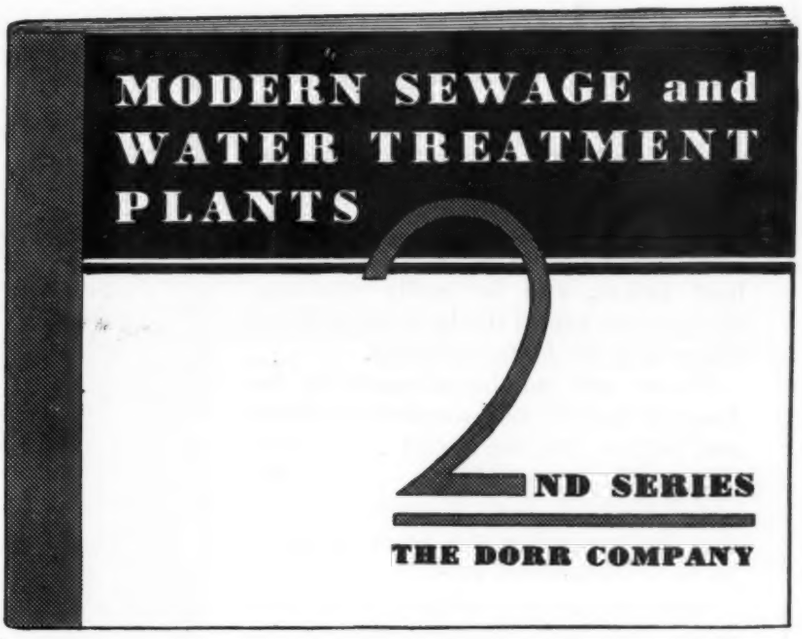
During 1929 the use of crushed concrete was greatly increased, so that it is interesting to note that the quantity of such material used, namely 9,878 cu. yds. in the Upper District and 15,970 cu. yds. in the Lower District, represents the equivalent of $50,000 that would have been necessary to expend for prepared materials for this purpose. The hauling and crushing of this material cost the city $35,236.91. It will thus be seen that the use of crushed concrete actually represents the saving to the city of approximately $15,000. It has the further advantage, however, in preventing the use of large pieces of concrete on the streets in such a way as to interfere with proper maintenance of them.

In addition to the crushed material, the division used, for filling streets, 35,354 cu. yds. of "hard fillings," 2,076 of shells, 761 of gravel, 346 of cinders, 654 of sand, and 8,933 of pilings.

Portable concrete crusher breaking up old concrete, New Orleans.

SANITARY ENGINEERS

You should have a copy of this boooklet . . . . .



Our first photographic booklet, which showed and briefly described thirty-six sewage and water treatment plants, was so well received by the sanitary engineering profession that we have prepared a second. In the new booklet, which has just been published, thirty-six additional plants are pictured.

On request to our nearest office we will gladly furnish copies to consulting engineers, municipal officials or anyone interested in sanitary engineering work.

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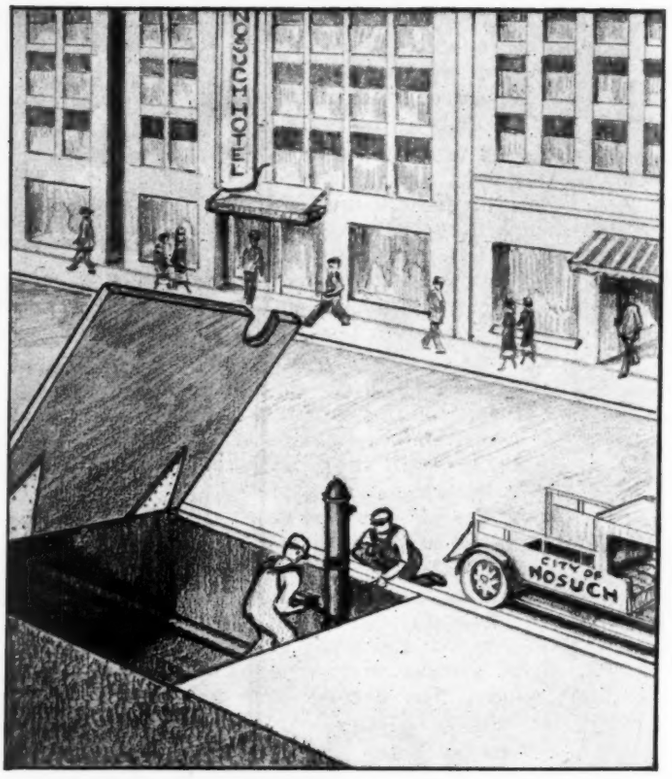
△△△ Little Points that loom big later △△△

If your pavements *were on hinges* you could not repair a Columbian hydrant any quicker



IT is never necessary to dig or break up pavements to repair a COLUMBIAN hydrant.

All of the working parts, even the lead gasket, can be easily removed through the top of the hydrant *without disturbing the hydrant barrel.*

There are no loose parts to be dropped into the bottom of the hydrant and flushed into the barrel . . . causing endless trouble . . . for the COLUMBIAN Seat Wrench in position for removing the working parts *forms a component unit.*

Construction is so simple, so trouble-proof, that on the average repair or inspection job the working parts can be removed, repaired and replaced *in 30 minutes.* Think how many hours it would take (and how many dollars) to break up pavement, dig up the hydrant, repair it and restore the pavement.

That is another one of the little points that loom BIG later . . . another reason why COLUMBIAN hydrants *cost less* in the long run.

Columbian hydrants rarely need repairs or adjustments. When they do the entire working parts are removed through the top of the barrel. A recent test shows that the average repair job on a Columbian hydrant requires only 23 minutes. That includes taking all working parts out and putting them back.

Columbian
IRON WORKS
CHATTANOOGA, TENNESSEE

RECENT LEGAL DECISIONS

By John Simpson

Unauthorized Work Accepted and Used

The Connecticut Supreme Court of Errors holds, Loomis v. Fifth School Dist., 145 Atl. 571, that where an addition to a schoolhouse was constructed and certain sanitary improvements installed therein, the addition being made without authority by a committeeman and the improvements installed by his orders, the school district, having taken no steps to stop the work as it progressed, and having accepted and used the improvements, was estopped from denying its liability therefor, the district having the power to contract for such installation. The court pointed out that there are a few decisions to the effect that nothing short of affirmative corporate action will constitute ratification by a public corporation of a contract entered into on its behalf without authority.

Advertised Method of Payment Is Part of Specifications

The Kentucky Court of Appeals says, Little v. Town of Southgate, 4 S. W. (2d) 711, 223 Ky. 735, that it is universally held that a contract has not been let to the lowest and best bidder unless all bidders have been invited to bid upon the same specifications. And the manner in which the contractor shall be paid is just as much a part of the specifications as the material which shall be used. A municipality would have no authority to make a contract in which there is included a different method of payment from that provided for in the ordinance and in the advertising.

Contractors' Lien for Street Improvement

Under the Kentucky statute providing that assessments for street improvements in excess of one-half of the value of the property assessed is void as to the excess, the Kentucky Court of Appeals holds, Knepple Sons v. City of Clifton, 19 S. W. (2d) 1070, that the court, in an action by the contractors against the property owners to enforce their lien and against the city to recover the amount remaining after sale of the property, must value the property and ascertain the correct amount of the assessment in advance of any sale. The purpose of fixing the values in advance is not merely to enable the owner to pay, but to define the extent of the contractor's lien so that either the contractor or the owner can know how much to bid on the property in order to protect his rights.

Road Contractor Bound by Acts of Agent Subcontractor

In an action for the value of steel ordered by a road construction subcontractor who under the contract between them was the defendant contractor's agent, the agreed on price was held sufficient evidence of the reasonable value, in the absence of anything to the contrary.

The contract provided that if a certain type of pipe were used, a cement collar should be put on the joints, and the subcontractor, as the contractor's agent, used the pipe, so that the contractor was required to put on collars. It was held that the contractor could not deduct the expense of doing so from the amount due the seller, although the latter knew the contractor did not wish such pipes used, the expense being the result of the contractor's agent's mistake.—Maeder Steel Products Co. v. Brewster, Washington Supreme Court, 281 Pac. 14.

Paving Assessment—Street or Boulevard

Under the Michigan decisions the paving of a boulevard is not a local improvement for which a special assessment may be levied. In Oprisin v. City of Detroit, 248 Mich. 590, 227 N. W. 714, the question presented was whether the street for which a special assessment was levied was a boulevard in fact. While the name given to it on the plot and its approval by the proper authorities may be said to prima facie establish its character, this may be overcome. It was held to be significant that in the dedication it was referred to as a street. As platted, it was but four blocks in length. It extended at the time of trial a distance of two miles, and in the connecting plats was stated to be an avenue. It was narrower than any of the streets involved in prior cases relied upon by plaintiff, abutting owners who claimed it was a boulevard, and had been treated as a street since taken into the city more than ten years before. It was held the street was not a boulevard in fact.

County Commissioners—Liability for Unguarded Bridge

Where the board of county commissioners of a county have a bridge constructed on a county highway and fail to have placed thereon banisters or guard rails, the Oklahoma Supreme Court holds, Parker v. Kimberlin, 282 Pac. 455, that their successors in office are not personally liable in damages to a person falling therefrom because of the negligent maintenance of such bridge, in that they failed, after assuming office, to have proper guard rails placed thereon, in the absence of a showing that funds were available for such purpose, or, by the exercise of proper diligence, could and should have been made available.

Valid Execution of Paving Contract

Where a city charter authorized the use of the state law regarding the improvement of streets unless otherwise provided by ordinance, a paving contract, to be paid for by special assessment, executed by the superintendent of streets as provided by the general statutes (Civ. Code 1913, par. 1961, as amended by Laws 1917, c. 34, §1) and not by the city manager, as provided by the city charter, was held valid.—Amish v. City of Phoenix, Arizona Supreme Court, 282 Pac. 42.

Removal by Third Persons of Barriers in Highways

A person charged with the duty of warning the traveling public of the unsafe condition of the highway who erects suitable barriers at a dangerous place, which barriers are subsequently removed or destroyed without his knowledge or consent, will not be liable to a person injured unless such removal has existed for such a length of time that a person in the exercise of ordinary care should have discovered it. The necessary period of time which must elapse between the removal or destruction and the injury, within which the person charged with the duty of giving warning, should have, in the exercise of ordinary and proper care, discovered the removal of such barriers, is a question for the jury under proper instructions.—Pratt v. Western Bridge & Construction Co., Nebraska Supreme Court, 226 N. W. 324.

Payment for Extension of Unit Basis Contract on Same Basis

The Oklahoma Supreme Court, Leininger v. Ward-Beekman & Brooks, 282 Pac. 467, holds that the nature of the work involved in the construction of a state highway system is such that no definite contract can be agreed upon, and a contract for such work must be sufficiently elastic to provide for the correction of engineering errors and changes in plans, and in order to provide therefor the state highway commission, in its discretion, is authorized to contract for such work on a unit basis; settlement under the contract to be computed at the completion of the work on a computation of the units of work performed.

Where a contract is made for the construction of a part of the state highway system on a unit basis, and the state highway commission extends that contract on the same basis to provide for the construction of a continuation thereof, and there is no fraud or collusion and no abuse of discretion of the commission, and the value of the work done under the extension agreement is reasonably worth the amount agreed to be paid therefor, the contractor is entitled to recover for said work the amount agreed to be paid as determined from a computation of the units of work performed.

Effect of Acceptance and Final Settlement as to Defects

A contract for the construction of a school building provided that no certificate given or payment made under the contract, except the final certificate or payment, should be conclusive evidence of the performance of the contract, and no payment should be construed as an acceptance of any defective work. The work was accepted and a final settlement made, after which it was discovered that the building had not been completed according to the contract and the plans and specifications. This was done by another contractor on bid therefor, and the township sued the contractor and his surety on the bond for the faithful performance of the contract. There was no allegation nor finding that the acceptance and final settlement were procured through fraud or mistake, and, in the absence of any such showing, it was held, Murphy v. State, Indiana Appellate Court, 168 N. E. 875, that the parties were bound thereby, and the contractor and surety were not liable for any defects or omissions appearing thereafter.

Reservation of Right to Reject Any and All Bids

The Michigan Supreme Court holds, Leavy v. City of Jackson, 247 Mich. 447, 226 N. W. 214, that the reservation by the municipality, where that is authorized, of the right to reject any and all bids, gives the right to let the contract to any bidder and reject the others, although the successful bidder is not the lowest bidder, provided the municipal authorities act in good faith in the exercise of an honest discretion. The court will presume the authorities acted in good faith in awarding the contract, and will only control their exercise of discretion in accepting or rejecting bids when necessary to prevent fraud, injustice or the violation of a trust.

Barricade to Excavation Should Be Obstruction and Not Merely Warning

A barricade required to be erected by a paving contractor to warn the public of an excavation and absolve the contractor from negligence should, the Louisiana Court of Appeals holds, Flynn v. Egan, 124 So. 598, be an obstruction and an actual impediment to travel, not merely a warning. The placing of a lantern in the middle of a plank loosely supported by tiles at each end was held not to be a compliance with the obligations of a contractor who had made an excavation in a city sidewalk seven feet long, four feet wide and three feet deep, particularly where similar barricades had several times, in the past, been removed by unauthorized persons, leaving the excavation without any protection whatever.

Petitions for Street Improvements Signed by Agents

Where a petition for a public improvement is duly filed as required by the Oklahoma statute, and shows on its face that the names of the property owners affixed thereto were signed by agents, the authority of such agents will be presumed, and need not appear thereon, but may be proven by evidence aliunde the record. The city council's acceptance of the petition, signed by such agents, is proof that the agency exists. The general manager of a lumber company shown to have authority to sign petitions was held authorized to sign a petition for a street improvement, and the petition was binding upon his principals.—City of Altus v. Bates, Oklahoma Supreme Court, 281 Pac. 138.

Correction of Irregularities in Paving Proceedings

Where a Kansas city of the third class in 1927 paves streets, including intersections of streets, under proceedings that are irregular, it can thereafter, under chapter 147 of the Laws of 1927, pass ordinances correcting the irregularities and relevying assessments to pay for the improvements.—Getty v. City of Syracuse, Kansas Supreme Court, 281 Pac. 883.

No Set Off Allowed of Illegal Taxes Paid

As matter of public policy, founded on the exigencies of government, municipal corporations must have present command of their current revenues. The Georgia Supreme Court therefore holds, Darby v. City of Vidalia, 149 S. E. 223, that property holders who have paid, whether voluntarily or by compulsion, illegal taxes in former years, have no right to set off (by injunction or otherwise) such payments against executions issued for the taxes of later years.

Property in Public Highways and Bridges

The Illinois Supreme Court, Stark County v. Henry County, 326 Ill. 535, 158 N. E. 116, holds that counties are but political subdivisions of the state, and are subject to the full control of the state, acting by general law through the Legislature, and the property held by counties is not private but public property. Public highways, and bridges on them, do not belong to the counties and towns which construct them, but are held by them in trust for the entire public (People v. Williamson County, 286 Ill. 44; Heffner v. Cass County, 193 Ill. 439) and the Legislature has supreme control of them unless restrained by constitutional limitations.

Street Improvement Ordinance Held Defective

The Illinois Supreme Court holds, City of Peoria v. Cowen, 326 Ill. 616, 158 N. E. 414, that an ordinance for a street improvement, including storm water sewer connections, which contained no provision in the estimate for the cost of cast iron manhole covers or necessary sewer pipe and did not describe the location of the sewer basins or the length of tile necessary to connect them with the sewer inlets was defective notwithstanding the city engineer testified that it was the city's purpose to pay any expense connected with the installation of the storm water sewer.

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Contractors, Engineers, and Efficiency in Highway Construction

SPEAKING before the Executive and Advisory Boards of the Associated General Contractors on April 30th, Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, made some interesting statements concerning the manner in which contractors are carrying out highway construction and what the bureau is doing to improve their methods. He said:

"We receive each month from our districts, which cover all of the United States, a statement as to Federal Aid projects which are unsatisfactory—on which progress has not been such as to complete within the time limit. For the present fiscal year, the cumulative reports show that the reasons for unsatisfactory progress, as detailed by our engineers in the field, have been:

Labor shortage	0.5	per cent
Materials	1.2	"
Inadequate equipment	8.2	"
Financial	1.1	"
Management	52.7	"
Weather	26.4	"
Construction difficulties	6.0	"
Cause not stated	2.6	"
Preliminary difficulties	0.3	"
Legal	1.0	"

As you see, nearly 75 per cent of the reported reasons for unsatisfactory progress revolve around the two items of management and weather. One of these can be largely controlled, while no contractor can entirely eliminate some of the weather vicissitudes."

There seemed to be room for considerable improvement in the item of management, and the bureau some time ago began making studies of this subject.

"Each year we pick out from the colleges twenty or thirty young men and, in cooperation with contractors who are interested in studying their own organization, we place these young men on the job to study each operation; to study the equipment relative to the key equipment on possible production. For example, in concrete road production, the amount of concrete that the mixer can produce is considered the key to the plant production. We estimate the amount of concrete that can be put through the mixer with efficient management and against this measure the progress in all parts of the work.

"Some of you know of the results, but it may surprise some that in a very careful study of more than 100 concrete jobs, we found that the contractors' equipment, due to major delays (that is, delays above 15 minutes each) was idle 40 per cent of the time. This was due to major delays, and takes account only of the time elapsing after the crew was on the job and equipment assembled and ready to work. We found further that the second class of delays, the minor delays, amounted to another 16 per cent of the time. So you see that today the bids really are necessarily based on somewhere around 50 per cent of the efficiency of the key equipment.

"This does not mean that we are able to get 100 per cent production; so it is not fair to use such figures to say that the contracting industry is only 50 per cent efficient." Averaging about 100 jobs, rain caused 9½ per cent of the delay and wet subgrade 8 per cent; a total of 17½ per cent probably unavoidable, leaving 82½ as the maximum practicable efficiency.

But among the avoidable delays were lack of prepared subgrade, 3 per cent; lack of materials, 3½ per cent; moving plant set-up, 3½ per cent; inadequate supply and faulty operation of hauling equipment, 3 per cent; mixer trouble, 2 per cent; lack of water at mixer, 2 per cent; loading plant trouble, 1½ per cent; miscellaneous causes, 4 per cent; a total of 40 per cent, each exacting a delay of more than 15 minutes.

"But the contractor is not alone responsible for these delays. Until we started these management studies, we had not appreciated—and I confess it with some chagrin—that we may design a road so that the contractor with proper equipment can produce efficiently, or we may make it impossible for him to use his equipment—any given equipment—efficiently. That is, we may design the cuts and fills so that the length of hauls so vary from day to day, that the number of wagons necessary to keep the shovel busy one day may be too many or too few the next. The contractor then is bound to compromise, and to have his whole equipment operating something under its efficiency, due to poor design by the engineer.

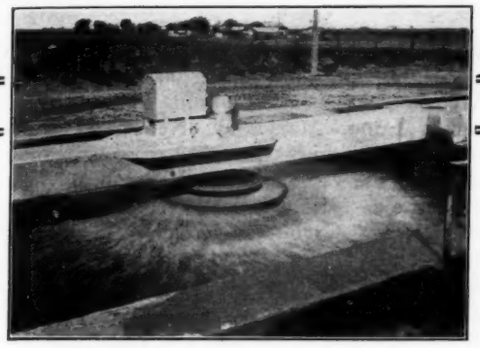
"We have a long way to go in the engineering field to design with efficient production in view. . . . The prequalification of contractor; the eradication of the incompetent, inadequately supported contractor; better bonding practices that we are getting through the information supplied through the Bureau of Contract Information; the study by the engineers of their design for proper execution by the contractor; and the bringing of men into the engineering field who know the contractors' problems, sympathize with him, and can be helpful in solving them, are important advances toward better public service."

Gasoline Taxes and Motor Registration Fees in 1929

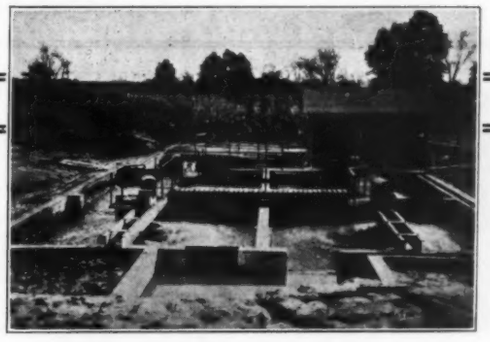
Taxes charged by each of the 48 states vary from two cents to six cents a gallon. Fees from nearly twenty-seven million motor vehicles.

THE Bureau of Public Roads has published complete statistics concerning gasoline taxes collected by the states in 1929, the registration of motor vehicles, and the registration fees, licenses, etc., collected by each of the several states and the District of Columbia. For the first time, this annual report shows the collection of gasoline taxes in every state, although Illinois collected taxes for only the last five months of the year and New York for only the last eight months.

The gasoline tax charged by each of the several states last December is as follows: 2c a gallon in Connecticut, Massachusetts, Missouri, New Jersey, New York, Rhode Island, Wisconsin and the District of Columbia. 3c a gallon in California, Delaware, Illi-



One of five Simplex aerators in service at the Frederick, Oklahoma, Sewage Purification Plant. Designed by the Benham Engineering Company, Oklahoma City, Oklahoma.



Sewage Purification Plant at Christopher, Illinois, four Simplex aerator units. Designed by McCarty & Elder Engineering Company, Marion, Illinois.

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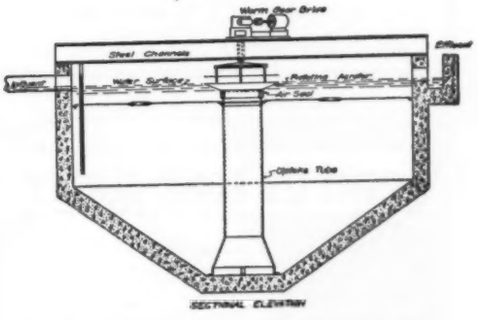
INSTALLATIONS such as those pictured above prove every contention made for the effectiveness and economy of SIMPLEX Surface Aerators in sewage purification plants.

Both Domestic and Industrial waste treating plants are operating successfully on the principle of sewage treatment through activated sludge produced by mechanical surface aerators.

May we explain more fully how the "Simplex" Aerator Unit gives greater flexibility in plant construction and operation with the least power consumption and maintenance costs?



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nois, Iowa, Kansas, Michigan, Minnesota, North Dakota, Oregon, and Washington. 3½c in Utah. 4c in Alabama, Arizona, Colorado, Idaho, Indiana, Louisiana, Maine, Maryland, Nebraska, Nevada, New Hampshire, Ohio, Oklahoma, Pennsylvania, So. Dakota, Texas, Vermont, West Virginia, Wyoming. 5c in Arkansas, Kentucky, Mississippi, Montana, New Mexico, No. Carolina, Tennessee, and Virginia. 6c in Florida, Georgia, and So. Carolina. These were the rates on December 31st. Colorado had increased its rates from 3 to 4c during the year, Florida from 5 to 6c, Georgia from 4 to 6c, Indiana from 3 to 4c, Kansas from 2 to 3c, Louisiana from 2 to 4c, Minnesota from 2 to 3c, Montana from 3 to 5c, Nebraska from 3 to 4c, Oklahoma from 3 to 4c, Pennsylvania from 3 to 4c, North Carolina from 4 to 5c, No. Dakota from 2 to 3c, Ohio from 3 to 4c, So. Carolina from 5 to 6c, Tennessee from 3 to 5c, Texas from 2 to 4c, Vermont from 3 to 4c, Washington from 2 to 3c, and Wyoming from 3 to 4c. Oregon has increased its rates from 3 to 4c, taking effect the first of this year.

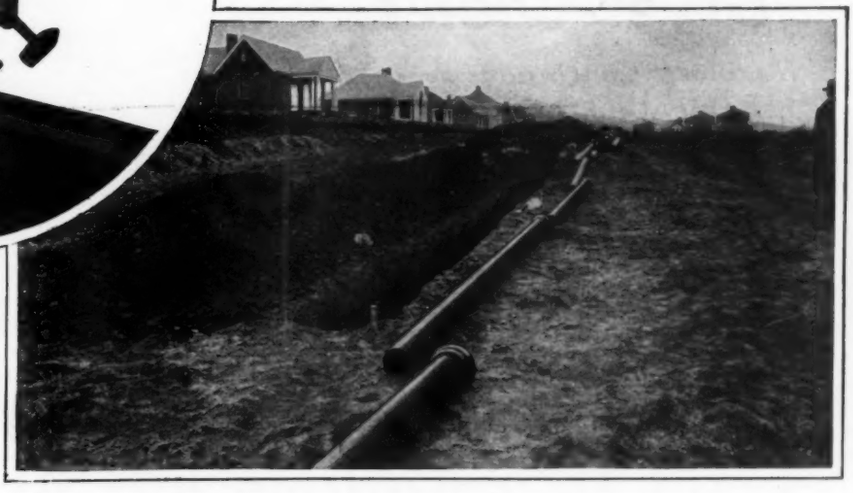
The net gasoline tax earned, after deduction of refund for exemptions, in all of the states and the District of Columbia totaled $431,311,519. The total collection costs deducted was $778,178, although nineteen states pay collection cost from other state funds.

Of the grand total earnings, $297,967,756 was used in the construction and maintenance of state highways and $85,113,708 of local roads; $23,371,785 was used for state and county road bond payments, and $24,405,027 for miscellaneous purposes. These miscellaneous purposes were for a reserve for refunds in the case of California; for town and city streets in Colorado, Indiana, Michigan, Wisconsin and the District of Columbia; for city streets, schools and permanent buildings and refund reserve in the case of Florida; for public schools in Georgia and Texas; in Maryland, for Baltimore city streets and grade crossings; in Mississippi, a special tax in two counties for a sea wall to protect a road; New Jersey, for the state Department of Commerce and Navigation; New York turned $951,000 over to New York City; Ohio, for municipal streets and $75,000 for a rotary fund for refunds.

The total amount of gasoline consumed by motor vehicles during the year was 13,400,180,062 gallons, allowing for estimated gallons used in Illinois and New York during the early months of the year when no tax was assessed. Based on amount received from taxes, California used the greatest amount of gasoline, 1,139,736,244, and Pennsylvania next with 1,047,914,175 and Nevada the lowest, with 16,307,535. New York taxed 962,601,285 gallons during the last 8 months of the year, or a rate of 1,443,902,000 for 12 months.

The total amount received by all the states in registration fees, licenses, permits, fines, etc., was $347,843,543. This was received from 23,121,589 passenger automobiles, taxis and buses; 3,379,854 motor trucks and road tractors; 193,044 trailers, and 114,845 motorcycles. In addition there were 33,179 United States cars, 118,828 state and local cars and 4,551 official motorcycles which were tax exempt. This is an increase of 2,008,319 registrations over the previous year. The number of motor vehicles registered shows an increase in every state except Florida, where there was a decrease of 2 per cent. The maximum increase in per cent was 19.7 per cent in the District of Columbia, and the maximum in numbers was 179,317 in New York State, or 8.6 per cent; the registration last year in that state being 2,263,259, leading California by 288,918, and Ohio by 496,645.

Just this is all it takes to lay this



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McWANE Pipe sizes are 1¼ through 12 inches. Either with or without the Precalked Joints.

In laying McWANE Precalked Joint Cast Iron Pipe you don't bother with a lot of men and materials. There is no yarning, no melting and pouring.

Instead, one man with a calking hammer can make a trenching machine hump to keep ahead of him as he finishes the joints. For all he has to do to make tight joints is to "socket and 'sock' it" with his hammer.

Everything else is done at the McWane foundries—the pipe delivered with better joints already in the bells than could be made in the trench.

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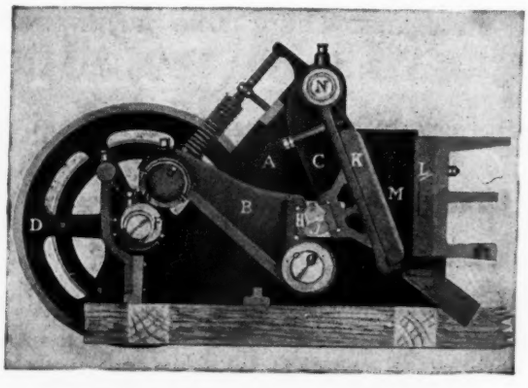

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Efficient Operation of Concrete Paving in Pennsylvania

(*Continued from page 36*)

Dumping—The first function in efficient mixer operation is dumping the batch in the skip as soon as it is lowered to the ground, and it must be lowered by the operator quickly as soon as all materials are in the drum. To accomplish this, the batch truck should pull away from the mixer just as short a distance as possible and still let the skip miss the truck in rising. There is too much tendency for trucks to pull away from 10 to 25 feet from mixer, which is a waste of power and time. The truck following the one at the mixer should keep as close to the one at the mixer as possible and still not so close that it will lose time in backing an excessive distance. Real efficient operation requires one truck dumping batches, a second in readiness, and a third getting into position. It is much cheaper to have an extra truck than endure delays due to lack of transportation.

Mixing—The next step in efficiency operation is the time of mixing. It should be determined, at the time of starting the job, how many *seconds* are required, and the mixer timing device set at *exactly* this time. A few seconds too much on each batch amounts to some batches lost for that particular delay. In Pennsylvania we insist upon an automatic timer which controls a locking device on the discharge chute of the mixer. As soon as the bell rings, the mixer operator should discharge the concrete into the bucket immediately, and when enough has discharged to insure all the batch leaving the drum before the new batch enters it, the skip should be raised. One of the greatest handicaps to production we have observed is the failure of the mixer operator to become a "part of the machine" at this time and function accordingly. Entirely too often he is at the opposite end of the platform, or engaged in conversation, or in other numerous ways neglecting his duty at this most important moment. Small delays are difficult to observe in this operation but they are vital from a production standpoint. Last year one of the mixer companies placed an automatic paving mixer on the market,—automatic to the extent that when the timer bell rang, it discharged the concrete into the bucket and raised the skip without any movement or action on the part of the operator. Other industries welcome, with open arms, any and all types of automatic equipment and train their operating organizations to meet the speed and other demands of the equipment. Not so with the paving industry. We had at least four of these units operating in Pennsylvania but only one contractor had the courage to operate the automatic device. Incidentally, this contractor put 360 batches through his paver in 10 hours which was 90 per cent of actual maximum capacity. Other contractors were afraid their men and trucks could not load batches fast enough and get away from skip in time for automatic action. In 1930 this paving manufacturing company had to add another feature to its machine to place the control of the automatic device in the power of and at the whim of the mixer operator. Such a failure to take advantage of automatic machinery is unknown in any other manufacturing industry and would not be tolerated in any but the paving industry. The challenge was issued but few dared accept it.

Dumping—As soon as the concrete is in the bucket and while the next batch is mixing, the concrete should be deposited on the subgrade. In Pennsylvania, as

Kahill Photo Studios

PORTLAND, MAINE, can testify to the economy of large diameter CAST IRON PIPE

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The "Q-check" symbol shown above has been adopted as the trade mark of The Cast Iron Pipe Research Association.

NEARLY a score of years ago, Portland, Maine, built a complete new water supply system. The chief supply line consisted of a cast iron conduit 42 inches in diameter and 17 miles long.

Recent examination shows this line to be in perfect condition. Flow tests indicate that the carrying capacity of this great main is unimpaired. During its more than 18 years of service it has never been shut down for a single moment. And as to repair charges, there are none. Moreover, the perfect condition of the pipe gives promise of a century of service still ahead.

The reason for the durability which results in the economy of cast iron pipe is its resistance to rust and corrosion. Water and gas mains of ferrous metal (iron and steel) with the exception of cast iron, disintegrate from rust. Cast iron pipe is the only ferrous metal pipe practicable for underground mains that rust will not destroy.

For information regarding cast iron pipe for water, gas, culverts, sewerage or industrial needs write to Thomas F. Wolfe, Research Engineer, 309 People's Gas Building, Chicago, Illinois.

Cast iron pipe bearing the "Q-check" trade mark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Company, 11 Broadway, New York.

CAST IRON PIPE

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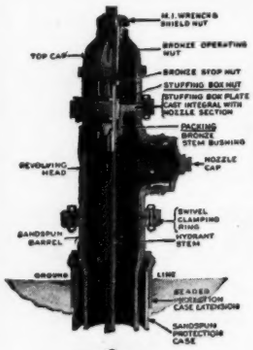
Hydrant Rammed—Town Without Water—A truck crashed into a hydrant in Claysville, Pa., and the town was without water for five hours. WATER WORKS ENGINEERING

Suppose They'd Had A Fire!

A DAMAGED Mathews fire hydrant cannot leak, and the broken barrel can be removed and replaced in a few minutes—*without digging or breaking the pavement.* One very important "health and safety" feature of the Mathews is that a broken Mathews barrel most always can be placed without shutting off pressure completely, thus leaving some water available.

The centrifugally cast SAND-SPUN barrel and protection case now used in the Mathews Modernized Hydrant are much stronger and tougher than ordinary castings. Other new and unique features make the Mathews more desirable than ever. It is interchangeable with old installations.



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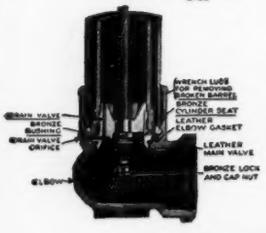

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in practically all other states, a "subgrade tester" is employed to locate high spots in subgrade, which must be removed and the grade retested before concrete is placed. This operation should be handled in such a manner that the section of the pit farthest from mixer be tested, corrected, re-tested if necessary and properly prepared so that concrete can be placed on this tested portion while the balance of pit is being tested.

Moving Mixer—The moving of the mixer should be one operation for the full length of replacement employed. If marginal bar reinforcement or suspended bar mats are used, the entire pit must be prepared and reinforcement placed before the concrete is deposited on subgrade. A boom considerably longer than the length of the reinforcement permits the paver to move and place wet concrete in a previously prepared pit and is of advantage in this case. Such a boom is the only chance of continuous operation for this type of reinforcement unless the subgrade is kept relatively low, at increased expense to contractor.

When it is time to move the mixer, the operator should follow his usual procedure of discharging and loading; the batch in the bucket should then be deposited on the subgrade and the mixer moved immediately, mixing a batch while moving. On a well organized job, the first batch after moving should always be deposited at the same particular location, preferably in the corner of the pit previously cleared up. As soon as the batch which was placed in the mixer just previous to moving has been mixed, it should be discharged into the bucket and a new batch placed in drum. This insures continuous operation and renders available immediately at least one batch of mixed concrete as soon as subgrade is ready. The presence of a batch in the bucket has a tendency to speed preparation of the subgrade. A good foreman and operator know the difficulty of getting hardened concrete out of the bucket and will force labor to hasten preparation of subgrade. A good maxim to follow is: "One batch in bucket, one in drum and one in skip at all times."

(*To be continued*)

Specifications for Fire Hose

"The selling of fire hose to municipalities has been in past years a field peculiarly characterized by large and in many cases unreasonable price differences at a given quality, believed by experts to be due to the fact that in the absence of specifications the field was open for gross and economically very significant misrepresentation of grade and performance, complicated by sales pressure, and in a large number of cases graft, direct and indirect, paid to municipal purchasing officers."

The above is quoted from the 1930 Year Book of the American Standards Association, being part of its discussion of the standard specifications for fire hose which were adopted last year after three years of consideration by a committee representing the Am. Soc. for Testing Materials, Am. Marine Standards Committee, Associated Factory Mutual Fire Insurance Companies, International City Managers Association, National Fire Protection Association, Dept. of Purchase of the City of New York, Railway Fire Protection Association, Rubber Manufacturers Association, Underwriters' Laboratories, Inc., and U. S. Dept. of Commerce Federal Specification Board.

These specifications cover both construction and performance under test of 1½-inch to 3½-inch, single, double and triple-jacketed cotton rubber-lined fire hose. It is believed that the general use of these speci-

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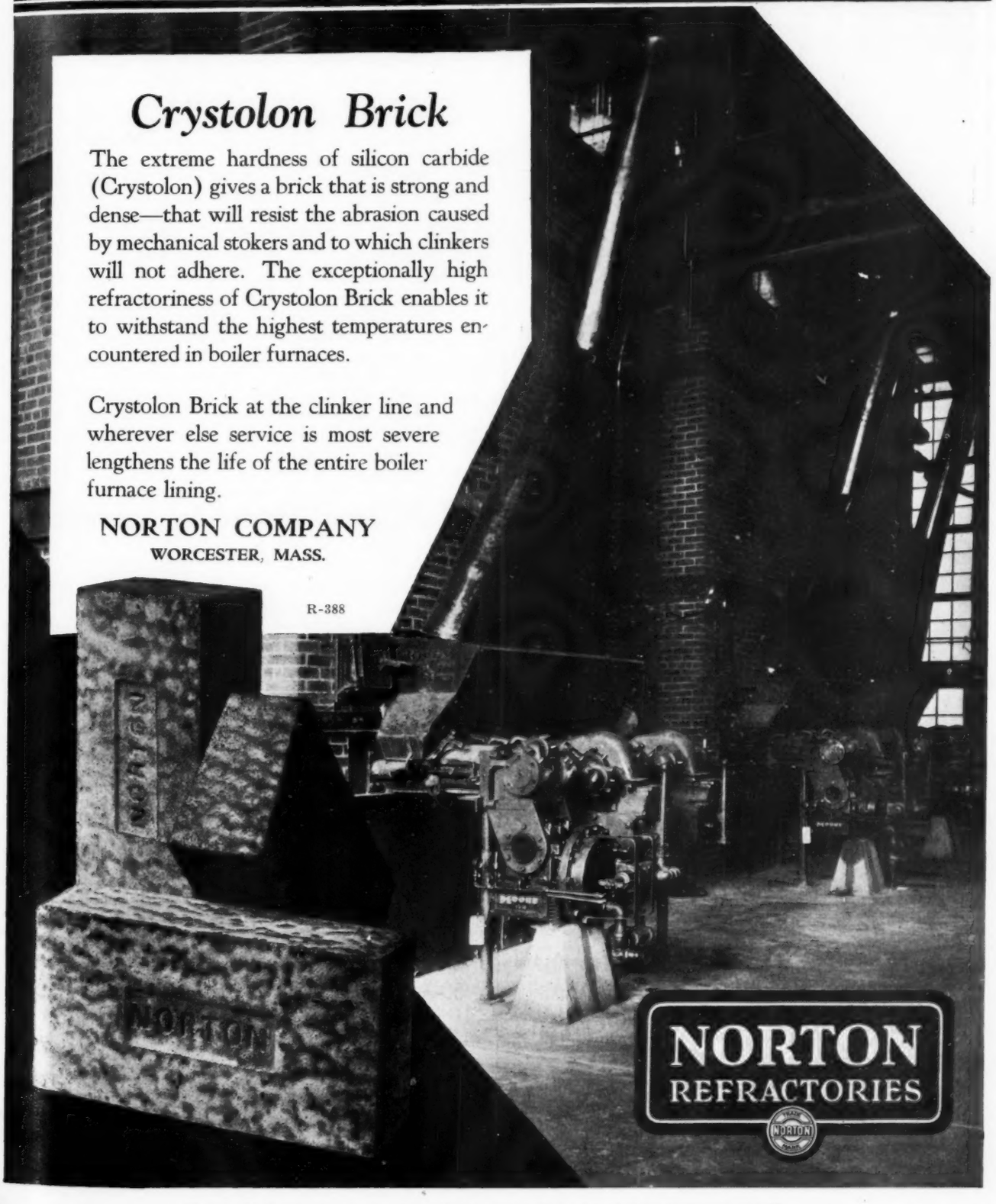

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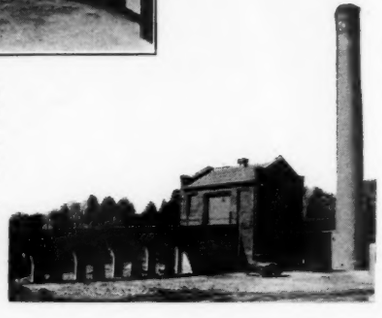

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fications will tend in large measure to eliminate the costly and unsatisfactory methods of purchase and sale referred to and develop a more economic price basis.

Copies of the specifications can be obtained from the American Standards Ass'n, 29 West 39th Street, New York City, at 25 cents each.

Lighting Mohawk Valley Highways

The Mohawk Valley Towns Association, whose object is the improvement and beautification of the Mohawk Valley, has as one of its aims the lighting of the main highway through the valley between Schenectady and Rome, a distance of 100 miles. With the cooperation of the supervisors of the counties crossed, more than twenty miles of highway lighting is now being installed, and it is hoped that the entire 100 miles will be lighted within five years.

Before installing the system, a study was made by lighting a test mile of road, selected for the difficulties which it presented.

The whole stretch was of black non-reflecting surface, and included two hills, two curves, a railroad on one side, and on the other side alternating roads, fields and river. Midway was an intersecting road and a bridge, joining the main road at right angles. At one end was an overhead pass with steep approaches and a right-angle bend at each end of the bridge. This road was studied for several months by public officials, illuminating engineers, newspaper reporters and others, considering it from various viewpoints, but safety first.

Lighting was found to increase the comfort and speed as well as the safety of night driving, showing up holes and obstacles in the road, illuminating the sides of it and also pedestrians, and minimizing headlight glare.

National Hydraulic Laboratory Assured

President Hoover has assured a national hydraulic laboratory by signing the following bill:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be established in the Bureau of Standards of the Department of Commerce a national hydraulic laboratory for the determination of fundamental data useful in hydraulic research and engineering, including laboratory reasearch relating to the behavior and control of river and harbor waters, the study of hydraulic structures and water flow, and the development and testing of hydraulic instruments and accessories: Provided, That no test, study, or other work on a problem or problems connected with a project the prosecution of which is under the jurisdiction of any department or independent agency of the Government shall be undertaken in the laboratory herein authorized until a written request to do such work is submitted to the Director of the Bureau of Standards by the head of the department or independent agency charged with the execution of such project: And provided further, That any State or political subdivision thereof may obtain a test, study, or other work on a problem connected with a project the prosecution of which is under the jurisdiction of such State or political subdivision thereof.

Sec. 2. There is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, not to exceed $350,000, to be expended by the Secretary of Commerce for the construction and installation upon the present site of the Bureau of Standards in the District of Columbia of a suitable hydraulic laboratory building and such equipment, utilities, and appurtenances thereto as may be necessary.

A number of Government departments have a long list of urgent problems awaiting solution, and the experiments in connection therewith will be taken up in the new laboratory as soon as it is completed. Among

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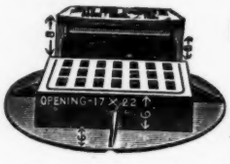

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these are questions relating to large reclamation and water conservation projects in the West, the control of erosion below spillways and dams, losses of head in large pipe and channel bends, the flow of water over dams, the entrainment of air at tunnel and syphon entrances, the regulation of rivers, the laws of silting and erosion in drainage ditches and streams, and the improvement of instruments and devices for measuring flowing water.

Owing to the great variety of problems which will be submitted for study, the equipment of the new laboratory will be designed to furnish the greatest possible flexibility of arrangement and combination, so that it can be adapted easily to the simultaneous study of a number of different problems.

The fixed equipment will include electrically-driven pumps for circulating the water, a large concrete water supply basin, a concrete measuring tank, several steel weighing tanks, elevated control tanks for supplying water under several different fixed heads, a stand-pipe and piping systems for distributing this water to all parts of the laboratory and for returning it from the models under test to the supply basin. A large unobstructed floor will be provided where a number of models can be built and tested simultaneously.

Industrial Water and Sewage Treatment Plants in New Jersey

(*Continued from page 41*)

Together with the sewage plants which have been installed during the past two years and those now under construction, a wide range of sewage treatment is represented. The types of plants include: (1) Plain settling and broad irrigation in the sandy regions along the coast, where large sandy areas are available and can be developed for crop cultivation by application of sewage and sludge. (2) Plain sedimentation, separate sludge digestion, trickling filters, and chlorination, where purification of sewage for nuisance prevention is of prime importance and a location is available sufficiently far from the institution. (3) Plain sedimentation, separate sludge digestion, trickling or contact filters, followed by sand filters where a water supply is involved. (4) Activated sludge and chlorination where insufficient area is available for other types of plants and a high degree of purification is desired. (5) Old installations of septic tanks or Imhoff tanks, followed by either contact filters, trickling filters or broad irrigation.

Operation Improvement—The survey also showed that at least eleven out of the then existing twelve institutional plants were seriously lacking in correct operation attention.

Since the success of proper operation is so definitely tied up with the interest of the operator in his plant, improvement in operating attention must necessarily be accomplished by the slow process of educating, by personal contact, the various institutional administrative staffs and plant operators to realization of the need and benefit derived from applied interest in the water or sewage plant. This method has been carried out from the beginning and the results to date are very gratifying from the standpoint both of improved attention and of the increased interest shown by the local institutional authorities in their plants when placed on an up-to-date basis.

Because of this interest, two institutions voluntarily have installed laboratory control at the plants, which consists of the simpler but valuable tests that the oper-

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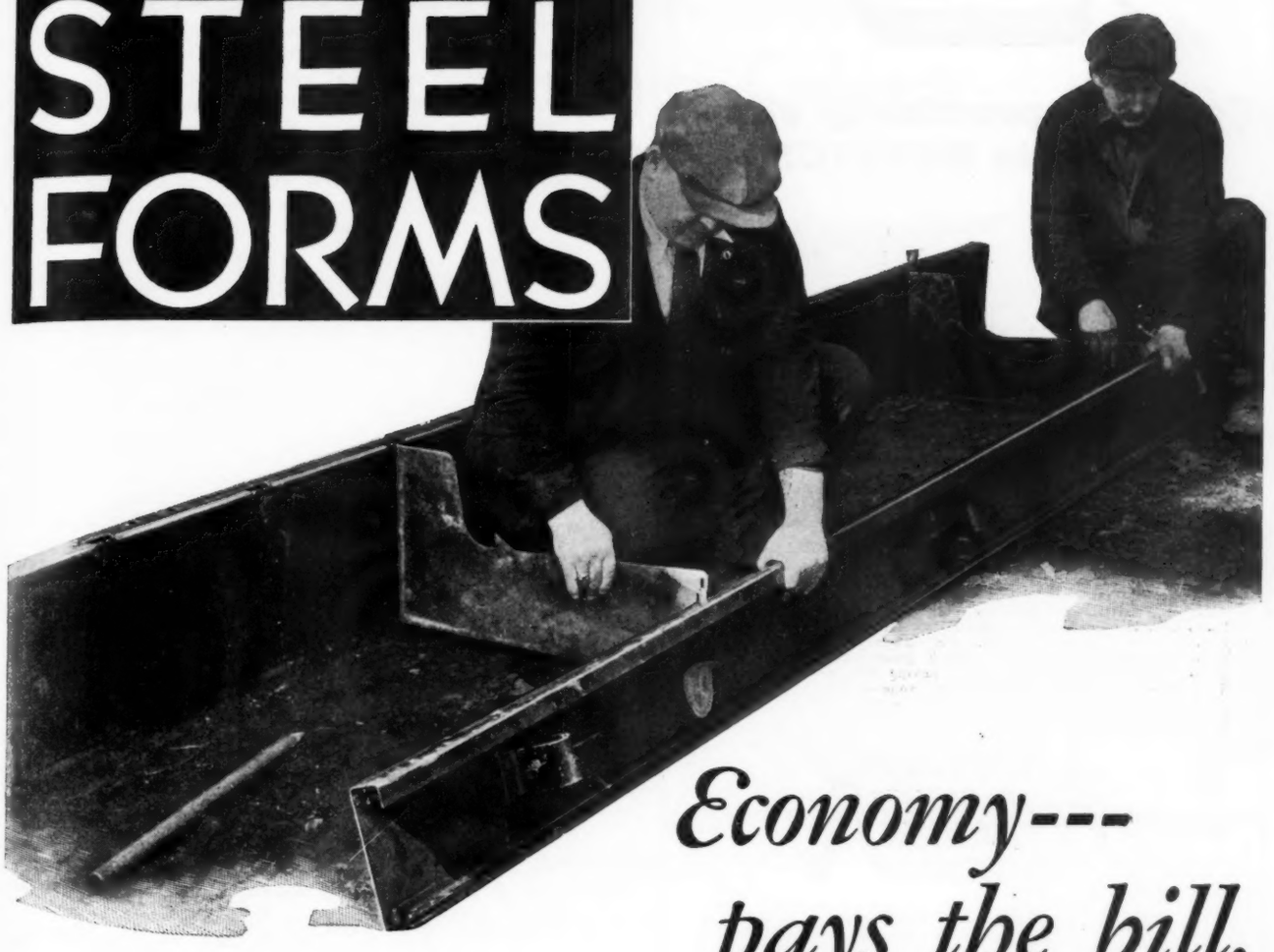

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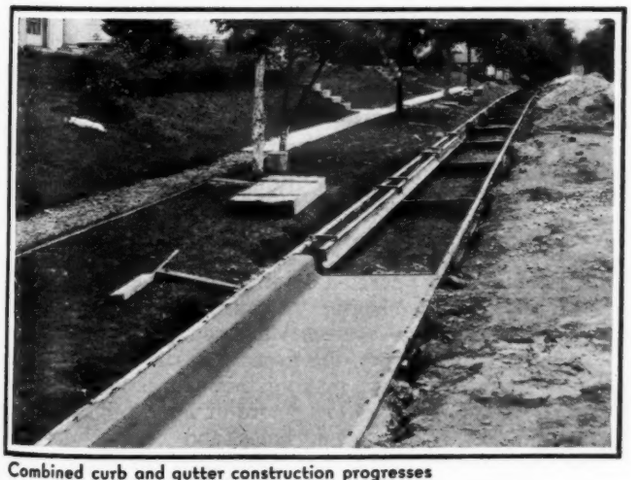

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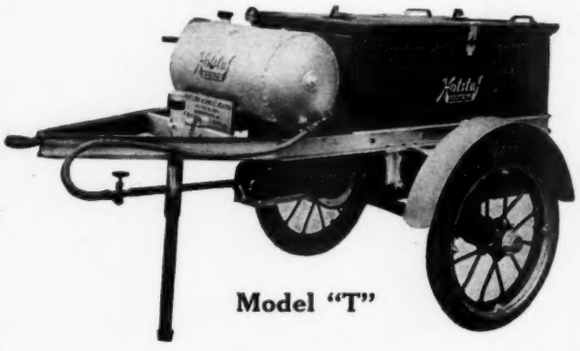

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ator has time to perform. It is the intention eventually to get these laboratory facilities installed at all plants where they are of value.

Control Work—Frequent visits are made to each institutional plant with as much regularity as is possible under the present stress of designing and construction work. At the present time an average of about fifteen visits per month are made.

This work consists of checking on the operator's interest, furnishing operating instructions and advice, and collecting samples for analysis in the laboratory. In the cases of those plants which have simpler laboratory control, these more extensive routine laboratory analyses supplement and check those at the plant.

In certain cases where special problems arise, a temporary laboratory is set up at the site of the plant for a more extensive and intensive study of the conditions. Such intensive studies are especially applicable to corrosive water problems in distribution mains, steam heating systems, and power plant boilers. In several cases this corrosive water presents serious problems and a continuous observance of the conditions is kept by as regular monthly analyses as possible.

Future Activities

The major part of the construction program now outlined will be completed within the next two years. It is hoped that there will then be more time for the equally valuable work of continuous, concentrated, systematic control and check on plants by laboratory analysis, to enable guidance and instructions to be given to operators under changing conditions of plant and stream. Receipt of the full value and benefit of that part of the construction program now nearing completion will be directly dependent on the amount of exercise of this control work, and the seriousness with which the operator takes his plants. It is obvious that the tasks represented by these two factors never cease as long as the plants exist and inconstancy of human interest prevails.

Unfortunately, the hazards and menaces of improper sanitary measures of treatment are invisible to the institutional officials and public at large until brought to light by some unfortunate sickness or loss of life, but public health workers possess the knowledge to detect these potential hazards and can eliminate them when furnished with the proper means. cooperation and support.

Foundation for Cobble Mountain Dam

(*Continued from page 33*)

which is held tightly in place by the inside pressure. Inside this chamber are a few paddles connected to a horizontal shaft operated by air, which keep the cement and water in the chamber in constant agitation. The discharge valve is connected to grout pipes by means of hose or steel pipes, the grout pipes being threaded on the upper end for making this connection. These pipes are set about a foot, more or less, into the rock at the top of the grout holes and cement packed around them to make the connection air tight, and extend slightly above the top of the wall.

It is good practice to wash out the grout holes before grouting is applied. The grout machine is connected to a ½ in. pipe, which is lowered inside the grout pipe to the bottom, or nearly the bottom, of the grout hole. The machine is filled with water, which is forced out under about 100 lbs. pressure, cleaning out of the hole any rock dust or other dirt, which escapes between the ½ in. pipe and the 2 in. grout pipe; which is repeated until the hole is thoroughly cleaned.

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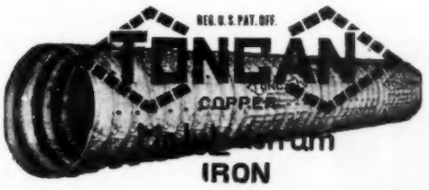

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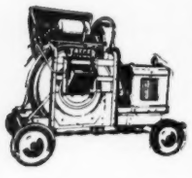

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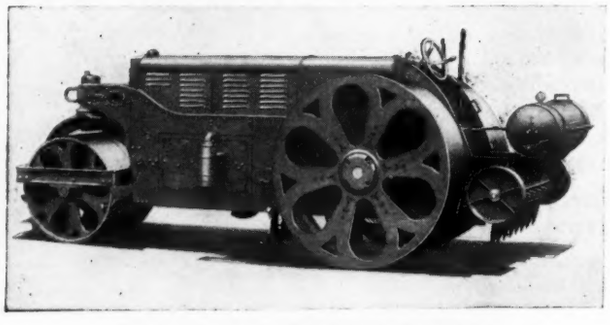

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Grouting is started with the lowest holes and then followed up in order. As a rule, the other holes act as vent pipes for the escape of air and should not be closed at the top. To mix the charge, water is introduced into the machine up to the required level, this depending on the mix, and the cement is introduced through the hole in the top. The opening is then closed and air applied both to operate the paddles and to give the necessary pressure in the machine, the latter being indicated by a gauge and kept constant by operating the air valve.

This pressure forces the grout out through the discharge connection to the grout pipes and, passing through them, it is forced into the crevices of the rock in the foundation, until no more will enter under the specified maximum pressure.

Small seams seal up quickly, but large ones sometimes require special attention. When the grout is flowing out freely without any apparent sign of sealing up, the seams should be closed with cement bags or otherwise.

A grouting machine operator and a couple of laborers above and at least one or two laborers near the grouting place will be sufficient to perform this work. A barrel of cement will produce 0.52 cu. yd. of grout with a three-to-one mix, and 1.55 cu. yds. with a ten-to-one mix. The cost on this job averaged $12.80 per yard for grout averaging 1 to 6 mix, exclusive of the drilling.

New Methods in County Highway Construction in New York State

(*Continued from page 28*)

reasonably consistent. For example, concrete pavements were listed as "fair," "good" or "excellent" progress, with the following results: Fair progress, 4.04 per cent of actual cost for total engineering cost. Good progress, 3.26 per cent of actual cost for total engineering. Excellent progress, 2.35 per cent of actual cost for total engineering. Some roads listed as fair are found to vary 1 per cent above or below the average, but this may be due to shortness of contract or other peculiarity.

The table shows that the average engineering cost for brick was 2.13 per cent, for concrete 3.21 per cent and for macadam 4 per cent. Of the *total engineering*, design cost 31 per cent, supervision 56 per cent, and the final estimate 13 per cent. This indicates the important effect upon the total engineering cost of the progress of the contractor, since the supervision must be continued during the entire length of a job which is making poor progress. Summing up all of jobs, both good and bad, the total cost averaged 4 per cent and that of design 1.25 per cent of the actual construction cost.

Table 2 shows the total cost and cost per mile of all of the pavements laid during the past three years, together with length and thickness. A summary of this table shows that concrete pavement 16 feet wide and 7 inches thick cost about $32,000 per mile; 18 feet wide and 7 inches thick approximately $40,500 per mile, and 16 feet wide and 8-7-8 inches thick, $33,825 a mile. Eighteen-foot brick pavement with 6-inch 1-2½-5 concrete base and 3-inch brick cost about $45,000 per mile. The one macadam road built during the past three years was 18 feet wide and 14 inches thick and cost $27,227 per mile.

These tables show only results during the past three years because the cost data previous to that were not reliable.

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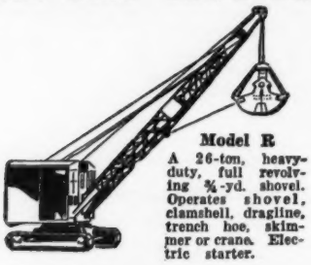

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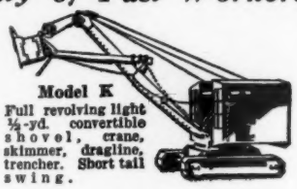
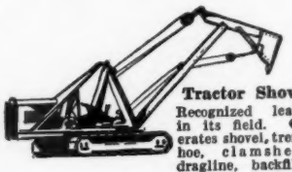


Model K
Full revolving light ½-yd. convertible shovel, crane, skimmer, dragline, trencher. Short tail swing.



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Engineering Organization

The engineering organization of the county is maintained on the same basis as that of New York state but on a much smaller scale. All county men work under the same civil service requirements as do state employees.

On new construction there are five full-time men and one part-time, under the direction of one man who in turn is responsible to the county superintendent of highways. All survey and design is carried on by this organization. Of the five men, two are capable of balancing and the other four work with them, plotting, running areas and making necessary computations. With this system, 23 miles of roads were surveyed and designed between January 1st and March 31st this year.

After the contracts have been awarded, the organization stakes out the roads. In supervising the work, the men are assigned to their respective roads, and are assisted by a few others who work during the summer as inspectors in charge of concrete work, etc., under the direction of these men. For inspecting at the bins or loading plants, college boys are hired, generally those taking engineering courses. The men in charge are instructed to leave nothing undone which will promote the progress of work as well as its proper construction, and it is believed that this relationship between contractor and engineer is a large factor in keeping the contract prices down slightly lower than on state work. It is to be realized that this relationship is possible only when the organization is small, so that the engineer in charge can be supervised two or three times a week. The one evil of the above relationship to be guarded against is that the engineer may become so anxious to help the contractor that workmanship is sacrificed.

Snow Removal in Monroe County, N. Y.

(*Continued from page 21*)

chloride or sand and salt were used to overcome the tendency of sand to blow off of dry ice. There were some complaints from car owners that the calcium chloride caused rusting and discoloring of metal-plated car bumpers, but no definite information has been secured in regard to this. Some difficulty was experienced in getting together men and equipment for spreading the sand, etc. The jobs were short and needed to be done early in the morning and at about the same time. Inasmuch as there was no means of telling when the ice storms were coming, all of the work had to be done on very short notice. Few of the hills are near sand pits and if loads of sand were dumped near the hills beforehand, they were invariably coated with ice and frozen so hard as to be almost useless. In a few instances a supply of sand was kept stored in places where it would not freeze. This method worked much more satisfactorily. The cost of treating the icy grades on all roads of the County System was allowed as a snow removal charge. The season of 1929-30 was an especially bad one for ice, the item of sanding and treating ice grades alone amounting to over $2550.

Public Opinion—There has been little objection to spending money for snow removal since the traveling public has come to realize the benefits derived. While there are occasional complaints, each one, when traced down, is found to be greatly exaggerated and often entirely groundless. It is felt that the public as a whole favors the snow cleaning program and appreciates the work done by the county in keeping so many miles of good road open the year around.

Engineering Societies

Sept. 22-26—NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention at Atlantic City, N. J. F. J. Gifford, Secretary, Dedham, Mass.

September 24-27 — INTERNATIONAL CITY MANAGERS' ASSOCIATION. Annual meeting at San Francisco, Calif. Executive Secretary, Clarence E. Ridley, 923 East 60th Street, Chicago, Ill.

October 6-11—SIXTH INTERNATIONAL ROAD CONGRESS at Washington, D. C. Secretary General, Thomas H. MacDonald, Washington, D. C.

October 7-10—AMERICAN ROAD BUILDERS' ASSOCIATION. International Exposition of Highway Equipment and Material at Washington, D. C. Secretary-Director, Charles M. Upham, National Press Building, Washington, D. C.

Oct. 9-11. — INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS. Annual Conference at Louisville, Ky. A. M. Anderson, 100 No. La Salle St., Chicago, Secretary.

October 13-17—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual meeting at Richmond, Va. Secretary, C. W. S. Sammelman, 315 Commercial Building, St. Louis, Mo.

October 27-31—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting at Fort Worth, Texas. Executive Secretary, Homer N. Calver, 370 Seventh Avenue, New York.

Dec. 1-5. — ASPHALT INSTITUTE. Ninth Annual Conference at Memphis, Tenn. Asphalt Institute, 250 E. 43rd St., New York.

International Association of Street Sanitation Officials

In October, the I. A. S. S. O. will hold its annual conference in Louisville, Ky. At that time there will be presented for adoption the first set of uniform sanitation standards that city officials have ever had made available to them. These standards will cover municipal activities such as garbage and refuse removal, snow removal, street and catch-basin cleaning.

Reports from the standards committee indicate that at Louisville the curb mile will be adopted as the basis for gauging and measuring street cleaning work in the future. In applying it as a unit, the miles that a machine runs parallel to a curb will be considered if machine cleaning is done. If cleaning is by hand or by flushing, the length of a street will be multiplied by two to get the number of curb miles and retain the uniform method of record-keeping.

Cubic yards will be presented as the basis for measuring catch-basin cleaning. It is believed that the volume of filth removed is a better unit of measurement than the number of basins cleaned, inasmuch as the sizes of basin vary so much in cities. The standard for this work will also take into account both hand and machine methods.

Garbage and refuse removal will be reckoned on the tonnage basis, under the proposal of the committee. Where it is impossible to weigh the refuse, provision has been made for record keeping on a cubic yard basis. In the case of snow-fighting, the mileage of streets cleared of snow will be the basis, but with provision also made for records on the cubic yardage.

The Association plans to issue a manual for the guidance and instruction of those in charge of sanitation work. This manual is expected to aid officials in planning, supervising and controlling their departmental work on the uniform standards basis. It is also expected to prove valuable in preparing budgets or appropriation estimates, keeping the public informed of departmental activities, and lastly, in aiding department heads to compare operations with those in other cities and on a more satisfactory basis than ever before.

New England Water Works Association

The committee appointed to nominate officers to the Association for 1930-1931 reports the following nominations: For President—George H. Finneran, Boston, Mass.; for Vice President—Richard H. Ellis, North Andover, Mass.; for Treasurer—Albert L. Sawyer, Haverhill, Mass.; for Directors—Howard M. King, Springfield, Mass., and Henry F. Hughes, Medford, Mass.

Personals

Charles E. Grubb, formerly county engineer of New Castle County, Del., has been appointed executive engineer of the county highway officials' division, American Road Builders' Association.

Paul B. Sutton, city engineer of Watertown, New York, since 1920, has been appointed city manager of Watertown, to succeed J. Walter Ackerman.

Ralph W. Orebaugh formerly an engineer with the Vermont state highway board was appointed city manager of St. Johnsbury, Vermont, to succeed Ralph D. Sherry who had been city manager for the past seven years.

Leonard Howell, city engineer of Ironton, Ohio, for the past ten years has become city manager of Ironton. He succeeds E. W. Fassett, former city manager.

J. Bryan Miller, city manager of Bryan, Texas, since June, 1924, has been made manager of Lubbock, Texas.

B. P. McWhorter has succeeded W. R. Neel as chief engineer of the State Highway Board of Georgia.

Alvord, Burdick & Howson, consulting engineers, have moved their office to 20 North Wacker Drive Bldg., Chicago, Ill.

John Klorer, formerly commissioner of Public Works of New Orleans, La., has been appointed chief engineer of the New Orleans Levee Board.

Irving C. Brower, who has been city manager of Lima, Ohio, for the past five years, has been appointed city manager of Greensboro, North Carolina.

After 18 years' service in the New Jersey Department of Health as chemist, F. E. Whitehead has resigned to become executive officer of a new combined health district comprising Riverside and Oradell Boroughs, Bergen County, N. J. The new position is unusual because its duties include not only those of health officer and registrar of vital statistics in the two municipalities, but also the function of superintendent of the two sewage disposal plants in the district. Mr. Whitehead was chemist in the N. J. State food and drugs laboratory from February, 1913, to February, 1920. During the last nine years he has been engaged in water and sewage investigations under direction of the bureau of engineering.

A. F. Dappert has been provisionally appointed assistant sanitarian of the Division of Sanitation, New York State Department of Health.

Mr. Dappert received the degree of C. E. from the University of Illinois in 1920, and in 1927 attended the Harvard Engineering School where he did special postgraduate work, receiving the degree of Master of Science in Sanitary and Municipal Engineering. For eight years he was connected with the Illinois Department of Public Health, first as assistant sanitary engineer and for the past five years as principal assistant engineer.

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The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

Industrial Notes

Hetherington & Berner and the Robert Berner Structural Steel Co., have consolidated under the name of Hetherington & Berner, Inc.

The Frink Sno-Plow Co., Clayton, N. Y., has granted manufacturing and sales rights for Frink Sno-Plows to the Davenport Locomotive and Manufacturing Co., Davenport, Ia., covering Illinois, Wisconsin and all territory west of the Mississippi River.

The Foote Company, Inc., Nunda, N. Y., manufacturers of Multi Foote Pavers, announce the appointment of G. F. Lowe Company, of Chicago, Illinois, as their general distributors in the north central territory, extending from western Michigan to Nebraska and from Kentucky to the Canadian Border.

The United States Pipe and Foundry Co. announce that deLavaud pipe is manufactured not only in the thicknesses and weights prescribed in the United States Government Specifications, but also in accordance with the thicknesses and weights of the American Water Works Association and American Gas Association Specifications and, furthermore, that they are equipped to manufacture any thickness or weight which may be required.

The sale of the North Little Rock Branch of the W. A. Riddell Company to the Southwestern Equipment & Supply Company, Market Street and Broadway, Little Rock, Arkansas, has been announced.

C. C. Johnson of Marion, Indiana, formerly connected with the Osgood Company, has been appointed District Sales Manager for Bay City Shovels in charge of Indiana and Ohio territory. C. H. Collier has been appointed District Sales Manager in charge of Bay City sales in the entire State of Texas with offices in the Burt Building, Dallas, R. D. Alrich, formerly of Chicago, will be located at the factory office in Bay City as Agency Sales Manager in charge of all distributors in the Central District. The Eastern Contractors Equipment Co., Frederick, Maryland, will act as exclusive Bay City Distributors for Maryland.

On July 21, the Four Wheel Drive Auto Company, Clintonville, Wisconsin, celebrated its twentieth anniversary of corporate existence. From the beginning in a rented blacksmith shop, the property of Otto Zachow, the inventor of the basic feature of the FWD truck, to present day housing under roofs covering about 280,000 square feet of floor space, at Clintonville, Boston, New York, Washington, D. C., Harrisburg, Atlanta, Chicago, Milwaukee, Kansas City, San Francisco, Los Angeles, and at Kitchener, Ontario. From the force of 1910, consisting of the master blacksmith and his two helpers, the pay roll of the company has grown until today it lists about 750 people, distributed through the offices, in the sales divisions, and in the factory. The 1930 force operates through fifty-three departments; those in the Export Service Department to be found in South America, in England and western Europe, and in Russia and those lands bordering the eastern shores of the Mediteranean.

Technical Publications

For Hauling Concrete.—An illustrated booklet has been issued by the C. O. Bartlett & Snow Co., Cleveland, O., describing their "Movable V" concrete body, which is claimed to lower costs on concrete hauling.

New Vibrating Screen.—Stephens-Adamson Mfg. Co., conveyor and screen manufacturers, of Aurora, Ill., have issued a 16-page catalog describing their new vibrating screen. The booklet contains construction details, dimensions, capacity data and installation photographs. It is printed in four colors and describes 16 features of the new screen. Several rather unusual features described are: grid type support for screen cloth; suspension mounting for sub-base; quick action clamps for screen changes and a self-contained vibrator mechanism which can be removed from the screen body as a unit.

Marion Shovels and Excavators.—The Marion Steam Shovel Company has recently issued a new bulletin, No. 343 describing their line of Type 450, 1¼ cu. yd. excavators in electric, Diesel electric and Gas-electric powers. This 16 page bulletin illustrates in detail the advanced construction of Marion small revolving electric powered excavating equipment. A similar bulletin, No. 339 has just been issued on the Type 450 Steam machines. A new bulletin, No. 343, has also been published illustrating and describing the Type 490 Electric heavy duty quarry or coal loading shovel. The Type 490 has a dipper capacity of 2¼ and 3 cu. yds., depending on its use as a quarry shovel or coal loader.

Copies of any of these bulletins may be obtained by writing directly to The Marion Steam Shovel Company, Marion, Ohio.

Handbook of Rock Drill Steel.—A new booklet by the Sullivan Machinery Company, 400 North Michigan Avenue, No. 72-K under the title of "Handbook of Rock Drill Steel," endeavors to give practical working hints as to the proper handling of the drill steel problem. The book contains instructions for operation of two different types of Sullivan Drill Steel Sharpeners, also of the Sullivan Drill Steel Furnaces, operated either by oil or by gas. There is a separate chapter on Pyrometers and Pyrometer Control, and on the Magnetic Indicator for indicating the critical point in heating steel for forging or tempering. There is a separate chapter on Heat Treatment of Drill Steel, and also an illustration of a drill sharpening shop, showing the proper layout of the equipment. A valuable section is that headed "Drill Steel Don'ts." The book is 48 pages, 8½ x 11 in size, fully illustrated with many cuts and diagrams of detail operations.

The Economy of Soft Water—A new 16-page bulletin on the Elgin Zeolite Water Softening System has just been published by the Elgin Softener Corporation. This discusses the advantages of soft water in the various industries, the problems of scale, rust, corrosion, incrustations and the influence of hard water upon fuel bills, textiles, linens, etc. The outstanding features of the Elgin Zeolite System are discussed as well as how to perform regeneration of the zeolite bed. A section devoted to boilerwater goes into the Elgin Zeolite-Deconcentrator combination, the continuous blowdown system with heat exchanger and the Elgin Deconcentrator. The bulletin is illustrated with nearly a dozen actual photographs of scale, corrosion, etc., and many installation views together with a schematic diagram of the Zeolite Softener installation in combination with the Elgin Deconcentrator for boiler water treatment and a diagramatic sketch of the Zeolite Softener and brine tank and control system. This bulletin is one of a series on different aspects of water treatment. Any of them will be sent upon request by addressing the Elgin Softener Corporation, Elgin, Illinois.

Spiral Welded Pipe.—Ingot Iron spiral welded pipe—a recent development in the pipe industry—has come to take a place in the field of pipe uses where continuous, economical, and dependable performance, under exacting conditions, is required. This booklet has been prepared to assemble useful data on diameters, lengths, weights, gauges, pressures, coatings, prices, and technical advantages. The availability of rust-resisting Armco Ingot Iron in this new, convenient, and practical form, furnishes an important utility for any construction requiring pipe-lines from 8 inches to 20 inches in diameter, where the problems of corrosion must be considered.

Portable Air Compressors.—Sullivan Machinery Company, Chicago, has issued Catalog 83-R, describing the Sullivan Vibrationless Portable Air Compressors. The book is 40 pages, 8½ x 11 in size, printed in two colors and it describes the Sullivan line of portable gasoline engine driven compressors, which has recently been increased by the addition of a 66-ft. unit. This unit, and the 110-foot, and 160-foot units, are two-cylinder, vertical machines. The 220 and 310-foot units are four-cylinder balanced twin units, the two pairs of cylinders being set at an angle of 90 degrees. The compressors are driven by direct connection to a Buda four-cylinder, four-cycle engine, with the exception of the smallest unit, in which a Continental engine is used.

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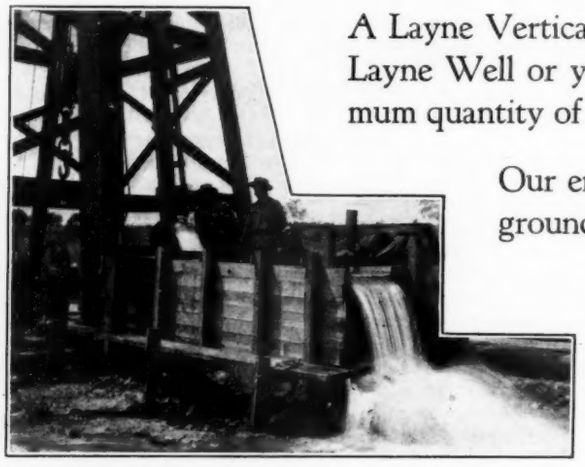

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The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

Engineering and Construction Equipment

New Machinery, Apparatus, Materials and Methods and Recent Installations.

"Caterpillar" Announces New Leaning Wheel Grader

A new grader featuring a 42-inch lateral side shift of blade that can cut a bank of 60 degree slope, is announced by the Caterpillar Tractor Co. This new grader, besides introducing new features of blade control, reach and range, has also the feature of leaning wheels.

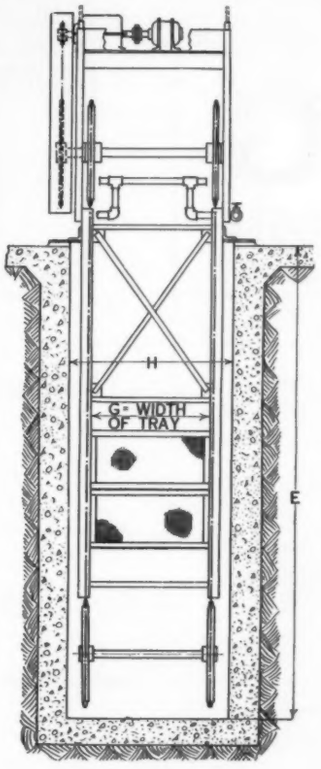
The new grader—called the "Caterpillar" Sixty Leaning Wheel Grader—is the heaviest of the "Caterpillar" blade graders, weighing 11,300 pounds without scarifier, and introduces a new centralized control system by which seven control wheels govern the nine important adjustments of blade pitch and position, wheel adjustment and steering.

Correct pitch of blade at all times, whether cutting or drifting, is maintained by the exclusive "Caterpillar" feature of 3-point control. The wide range and reach of blade is made possible by a 42-inch lateral side shift, by 3 positions of the connecting link between side shift and circle crossbar, by 3 blade position connections with the blade beams and by 4 positions at the extensib'e lifting links. The blade is thus enabled to make a high reach for bank cutting of 6 ft. 6 inches and can cut a slope of 60 degrees.

New Link-Belt Traveling Water Screen.

Link-Belt Company, Chicago, Ill., have just issued a 24-page illustrated Book No. 1252, in which their new, 1930 model water screen is shown.

Particular stress is laid on the construction of the screening trays and baskets for elevating the trash, it being stated that the tray construction is so different that each tray now has approximately 10% greater depth of effective screening area.



Link-Belt Traveling Water Screen

Another feature is the overlapping of the trays, and the use of seal plates between the ends of the trays and the rugged elevating chains to which they are secured, whereby the passage of trash is prevented, since the space between trays, in the guides, and in the boot, is reduced to an absolute minimum.

As in all traveling water screens, the screening surfaces are automatically cleaned by sprays of water, which, with the refuse, falls into a sluiceway. Screen trays can be cleaned either on the ascending or descending run, according to individual requirements.

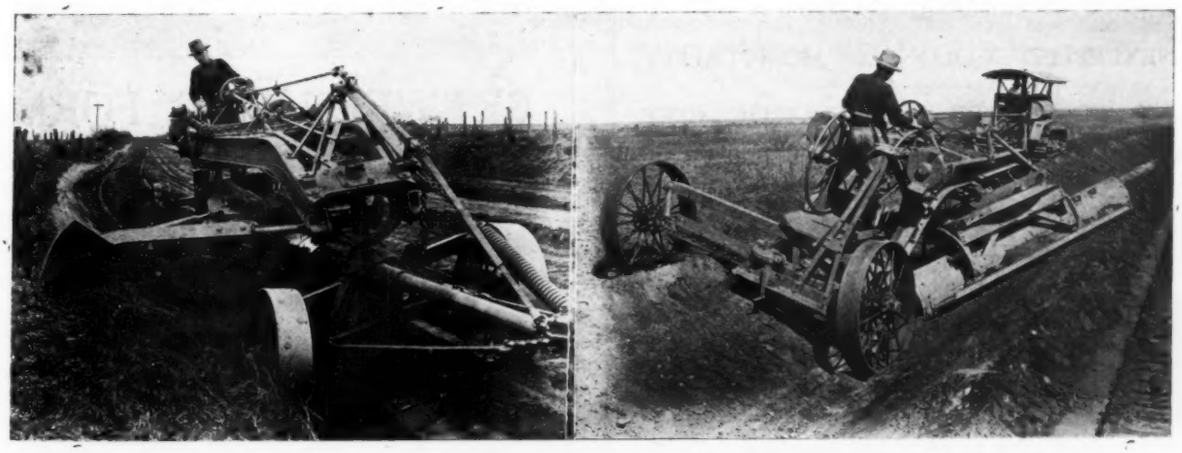
Metalweld-Worthington Introduce New Features

The Metalweld-Worthington organization is introducing a number of revolutionary developments in their latest type portable air compressors. The H-Model Continental engine has been adopted, and is being used as the power unit for all their 220, 280 and 330 cu. ft. displacement compressors. This engine was described in *Public Works* for January, 1929.

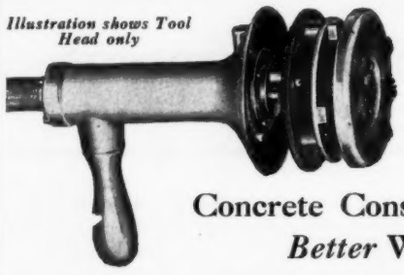
Two air cleaners are furnished with each unit, one for the engine and one for the air compressor. A reliable approved type of gas filter has been added, as well as a magnetic gasoline gauge which does away with the necessity of using a measuring stick.

Clark Water Meter Tester Scale Beam

The H. W. Clark Co., Mattoon, Ill., announces a change in their meter testing machines so as to register more clearly the percentage of inaccuracy on the basis of meter registration. The new scale also eliminates the loose weights formerly hung on the end of the scale beam, and the sensitiveness of the scale has been considerably increased.



New Caterpillar Leaning Wheel Grader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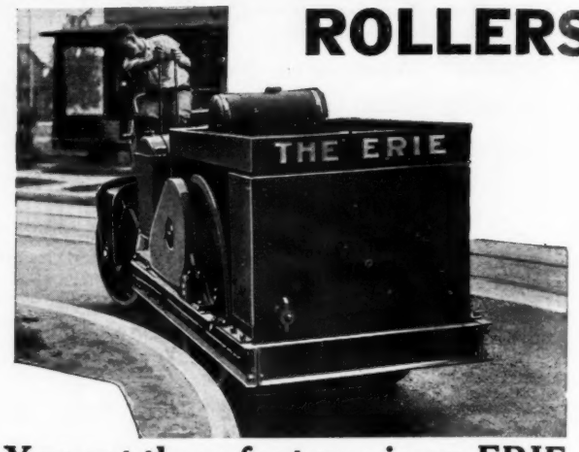

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The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

New Littleford Trailer Attachment for Automatic Road Marking Makes Speedy Marking Possible.

New Traf-O-Mark Trailer Attachment

By use of the attachment shown in the accompaning illustration, which is manufactured by Littleford Bros. Co., Cincinnati, O., practically automatic road marking is accomplished. The opeator starts the car and guides it by watching the chain follow the edge of the road as it dangles from the guide arm. The Traf-O-Mark requires no attention other than to see that the paint reservoir is kept full.

When the operator completes a curve or the crest of a hill and desires to proceed without making a mark, all he has to do is raise the marking roller. The guiding arm at the front of the car is hinged and can be thrown back over the right front fender.

When a marking job is completed both units can, in three or four minutes, be removed and placed in the car. However, it is not necessary to remove the guide arm. When thrown back over the right front fender, it is completely out of the way and does not interfere with fast driving of the car.

Sure-Trac Rubber Crawler New Feature of Galion Motor Grader

Another new development in motor grader construction—the Galion Sure-Trac Rubber Crawler—was recently announced by The Galion Iron Works & Mfg. Co., Galion, Ohio. This rubber crawler provides the grader with smooth continuous track with positive traction under all working conditions.

Galion E-Z Lift Motor Graders are powered by the McCormick-Deering 20 Industrial tractor. Equipped with the Sure-Trac Crawler a higher operating speed may be maintained as the rubber track is designed and constructed to stand up under high speeds. Greater operating economy is also assured by a guarantee of 5,000 miles of service backed by the world's largest tire producer. After traveling more than 17,000 miles in sand territory a recent test showed practically no wear upon the rubber crawlers.

Tire chains, easily placed and removed, may be used with the Sure-Trac Crawler when working in unusually slippery soil, or in snow and ice.

Miami Tractor Power Shovel for "Caterpillar" Tractors

A new piece of equipment produced by The Miami Trailer-Scraper Company, Troy, Ohio, is the Miami Front End Shovel for "Caterpillar" tractors, Models Ten, Fifteen and Twenty.

This shovel is manufactured in both low and high lift models, the low lift having a dumping clearance of 30 inches, while the high lift has a dumping clearance of 6 feet.

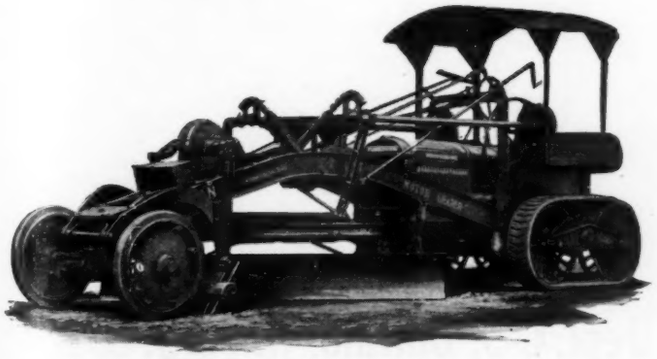
The Miami Shovel is furnished complete, as illustrated, no extra tractor parts being required in setting up. It has a capacity of 8 to 9 cubic feet for the Model Ten, ½ yard for the Model Fifteen and ¾ yard for the Model Twenty.

A 9-Yd. Rubbish Body by Wood

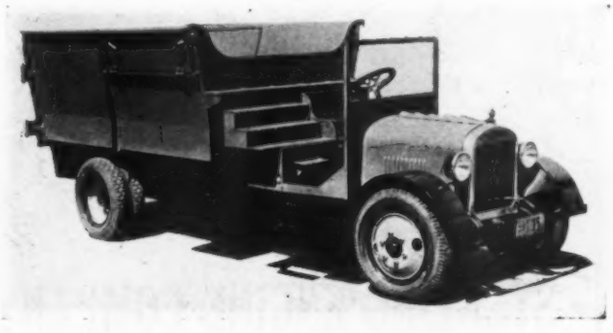
Herewith is shown a new type of large-capacity rubbish body, mounted on a Fageol Flyer chassis, for service of the Modesto, Calif., Garbage Company. It was built and installed by the Wood Hydraulic Hoist & Body Company, at San Francisco. The body capacity is nine cubic yards, and with it is mounted a Wood Model F-2 underbody hydraulic hoist, for easy, quick dumping of large loads.

The unusual flared sides, with the side provide for easy loading of rubbish. The seat, seat box, steps and tool boxes form the front of the unit.

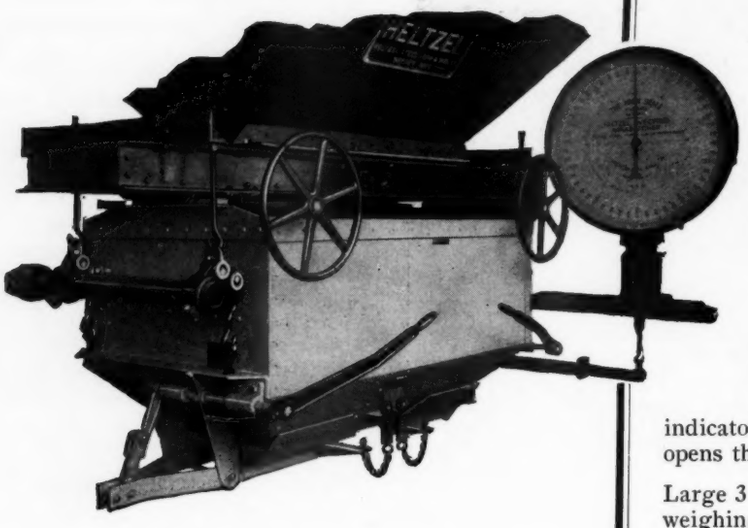
The Miami Tractor Power Shovel for Caterpillars Is An Economical Small Unit



Galion Sure-Trac Rubber Crawler



A 9-Yard Body for Rubbish



We also manufacture steel forms for streets, curbs, sidewalks, curb and gutter, manholes, concrete pipe, steel bins, street joint, measuring hoppers, volume and weighing type, bridges, bulkheads, sub-grade testers, trail graders, mortar boxes, etc.

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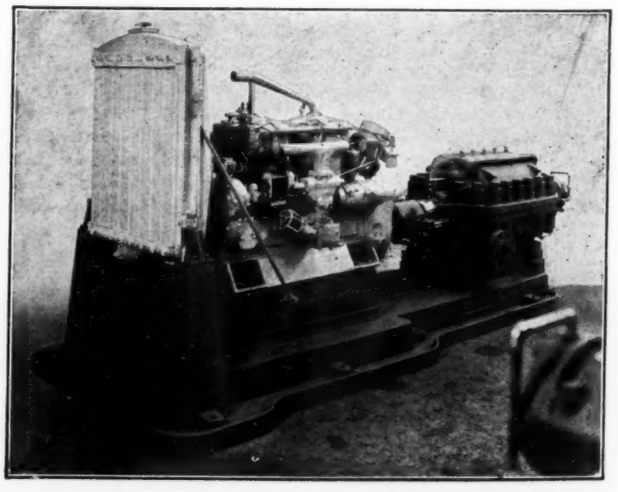


Cameron centrifugal driven by 4 cylinder Model FC 100 H. P., Sterling engine at Tampico, Mexico, for standby service. Where water contains foreign matter radiators are used.

STERLING ENGINE COMPANY, Dept. C-5, Buffalo, N.Y., U. S. A.

The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

Barnes Power Diaphragm Pump

The Barnes Mfg. Co., Mansfield, O., has developed a closed diaphragm pump which can be changed over in 2 minutes, it is stated, so that it will force the water over a spoil bank, up to head of 35 feet, or transport it some distance from the job. This pump is not intended for long-continued lift or force-pumping, but can be used when necessary and often saves the purchase of another pump.

It is made in a variety of sizes.

Barnes Power Diaphragm Pump

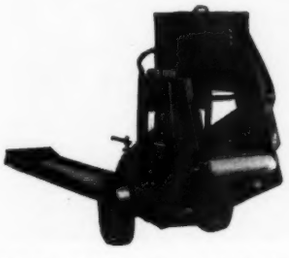
The Weston Testing Screen

The Hendrick Mfg. Co., Carbondale, Pa., manufacture the Weston testing screen, which was invented and designed by a producer of crushed stone to meet the present day requirements for accurrate testing of large samples of coarse aggregate.

Tests show the Weston screen to be just as accurate as the hand method. In order to run a sample through this screen it is only necessary to run same from two to three minutes. The sieves may then be lifted off for inspection and weighing. Having each size of aggregate in a separate sieve allows testing engineers to make a visual inspection of each size.

Portable Machinery Company Under-Car-Unloader

The Portable Machinery Company with factories at Clifton, N. J., Chicago, Ill. and Montreal, Canada has recently added an Under-Car-Unloader. This is a new development of the belt type, capable of carrying the material from underneath the car and then elevating it high enough to deliver to the feed end of a loading or piling conveyor without a pit of any kind being provided. This development not only saves the work of digging and the inconvenience of the pit but also enables the user to unload at any point along the track without special preparation. It will handle sand, gravel, crushed stone and any other material which is shipped in hopper bottom cars. Also the section which reaches across the tracks is long enough to pick up all of the material from the far side of the hopper and being only 2¾" thick it will readily fit between the tracks and the lowest type car hopper. It has a capacity of 1½ to 2 tons per minute and weighs just over 1000 pounds.



The Portable Undercar Unloader

The Weston Testing Screen

Domestic Ball Bearing Centrifugal Pumps

The Domestic Engine & Pump Co., Shippensburg, Pa., manufacture a series of ball bearing centrifugal pumps with 2½, 3, 4 and 6-inch suction and discharge. Radial load and impeller thrust are carried by ball bearings in this line of pumps. The impeller is of special design with wide passages to permit large size material to pass through without clogging or injury.

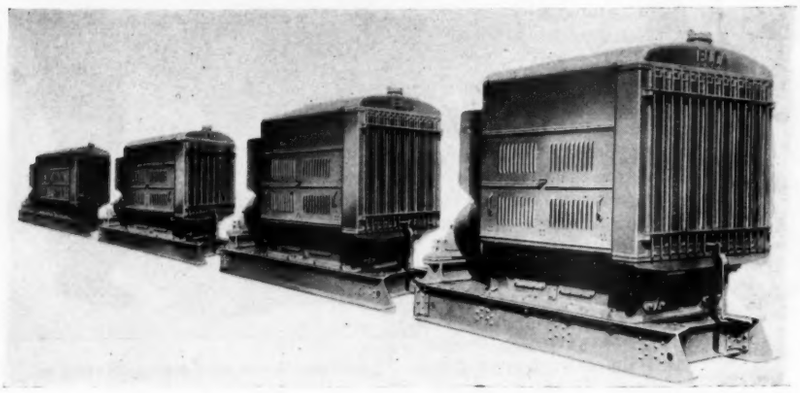
These pumps are of especial value in handling water containing solids, for pumping water from manholes, catch basins, excavations, trenches and other places where conditions are liable to be difficult. The smaller sizes are mounted on 2-wheel trailers and the larger ones on a 4-wheel truck.

This entire line of pumps has the same general features, only the capacities are different and the openings in the trash handling impellers are larger in the larger pumps.

The Domestic Ball Bearing Centrifugal Pump

Diesels to New Mexico for Highway Work

The Buda Company at Harvey, Illinois has shipped to the New Mexico Construction Company, Albuquerque, New Mexico, four Model D4-30 Buda M.A.N. Diesel engines. These units develop a maximum of 120 B.H.P. and operate at a speed of 800 r.p.m. to 1000 r.p.m. They are to be used for operating Cedar Rapids No. 2 Crushers, in connection with highway construction. These engines are mounted on skids, which enables them to be moved from one job to another with a minimum of effort. They are completely enclosed with sheet metal housing, which may be locked to eliminate any danger of tampering with the engine.



Diesel Engine Shipment for Road Work in New Mexico

The net weight of these units, complete, is approximately 9000 pounds. Starting is handled by means of a small two cylinder air-cooled gasoline engine, which is mounted on the flywheel housing and starts the Diesel through a special Bendix drive. This eliminates the use of accessories and makes the units complete and self-contained.

The Buda Company are building two otner sizes of these engines, developing 92 h.p. and 180 h.p. respectively, and numbers of these engines are being furnished for many different classes of service.

A General Utility Hoist by Trackson

A new hoist has been put on the market by the Trackson Co., Milwaukee, Wis. This hoist is easily and quickly mounted on the Model 20 McCormick-Deering tractor and the portability thus achieved is an outstanding advantage. Among the many uses for this equipment are contractors' general hoisting, double elevator work on building construction jobs, dragline operations in sand and gravel pits, backfilling trenches and ditches, pile driving, house moving, log skidding, loading and decking, stump pulling, erecting telephone poles and stringing wires, moving derricks and boilers in oil field work, pulling rods, tubing and casing from oil wells, erecting tanks, etc.

The new machine has a number of special, exclusive features, such as larger cable capacity, improved screw type clutches, oversized drum shafts, hand lever control, and ready adaptability from the single to the double-drum type. The auxiliary drum may be attached as the user needs it, without any alteration to the main drum unit. It is mounted directly over the main drum, making a complete and compact two-drum hoist.

Installation of this hoist on either the McCormick-Deering wheel tractor or the Trackson crawler unit is a simple matter. There are no holes to bore and no construction changes are necessary. The hoist is merely mounted on the power unit by means of 6-inch steel channels which extend from the front of the hoist and are attached to the tractor rear housing.

The Trackson hoist is built both as a portable machine for tractor mounting and as a stationary hoist. The latter has a material elevator spool which is adapted to endless cable work such as operating material elevator cages in construction work. The line speed is 200 feet per minute in both high and reverse gears, and 136 in low gear. The elevator spool is interchangeable with the gypsy spool and can be installed quickly.

In the stationary hoist the clutch is of the dog type, transferring the power from the main drum shaft to the elevator spool. The latter can be operated independently of the main drum. The brake is of extra-large capacity, insuring long wear to the brake lining and ample ability to hold the load. It is operated by a left-hand lever and locking ratchet.

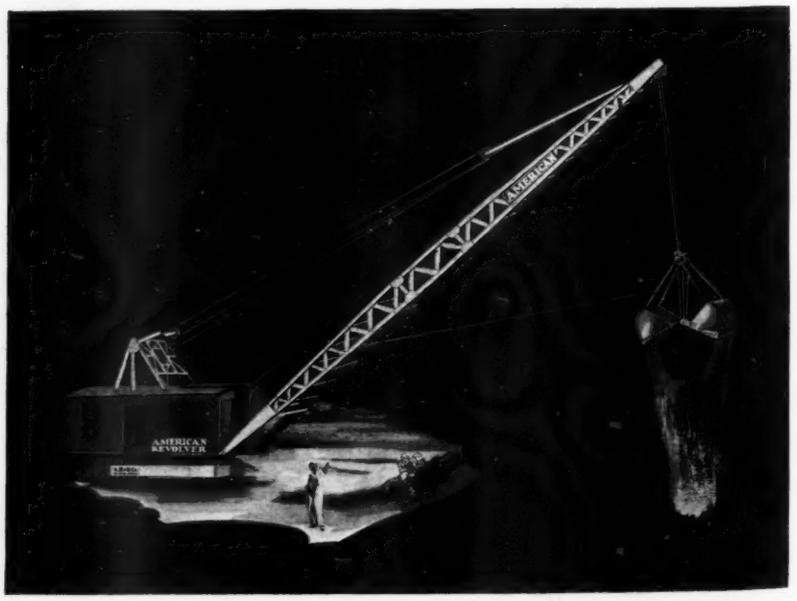
American Heavy-Duty Derrick Crane

A new full-circle, long-boom, broad-gauge, crane and dragline has been brought out by the American Hoist & Derrick Co. of St. Paul, Minnesota for use in the general construction, excavating, and sand and gravel industries. This machine will be known as the "American Revolver."

Its main features are a combination of the advantages of both derricks and locomotive cranes—the ability to handle heavy working and lifted loads at wide working radius; ease of movement by wheel mounting on track, or skid and rollers over rough ground; simplicity of its all steel construction; stability, and ready adaptation to all classes of heavy crane, derrick, or dragline work. Either steam, electric, diesel, or gasoline power can be furnished.

Mounting can be arranged to suit requirements. It can be mounted with eight double flanged wheels, wood skids, barge, pier, or gantry type. It is available in three sizes with booms 75, 85, or 100 feet long and turntable diameters of either 14 or 20 feet.

The "American Revolver" is manufactured as a complete unit by the American Hoist & Derrick Co. and offered by them as an addition to their standard line. Production of these machines will be carried on at both New York and St. Paul.



American Revolver Crane for Heavy Work

Spring Wind-Up for Crawler Dump Wagons

The Western Wheeled Scraper Company of Aurora, Illinois, has developed a simple and easily operated door control for Western Crawler wagons, which can be attached to wagons in the field as well as to new wagons in the shop. It is a new departure in door control mechanism, operating through the two most economical forms of power —gravity and spring action. The spring acts instantly to close the doors and in its entire design the mechanism meets the need for simplicity, speed, safety and economy.

The mechanism in brief is as follows: A large spring with sufficient initial energy to close the doors tight under all conditions; a toggle and ratchet arrangement, completely enclosed, to hold the doors closed against a load and

Cast-Iron Cut-in Connection for Sewers

open against the spring pressure; a pawl and ratcet device so constructed that a single pull on a rope running to the tractor or a single pull on the lever to which the rope is attached will trip the load and a second pull on the same rope or lever will close the doors when the wagon has moved forward free of the dumped load. As this mechanism is controlled at all times by either the tractor driver or the man on the dump, it eliminates the man formerly needed to trip and wind-up the doors, as well as increases production by its greater speed. No extra attachments are needed for the tractor.

A New Metal for Chains

A new line of cast chains showing remarkable strength and durability in comparison with malleable chains has been placed on the market by Link-Belt Company, Indianapolis. These chains are sold under the registered trade name of Promal.

The manufacturers of Promal expect that it will replace many elevator, conveyor and power transmitting chains where malleable iron chain has commonly been used. Promal Chains are particularly recommended for four general classes of service: (1) chain drives, elevators and conveyors operating under gritty or abrasive conditions; (2) chain drives where greater strength is required than the corresponding size of malleable iron chain provides; (3) drag, scraper and flight conveyors where the chain drags and is subject to abrasion; and (4) heavy duty drives of comparatively high speed, short centers and large sprocket ratios.

Improved Garbage and Refuse Collection

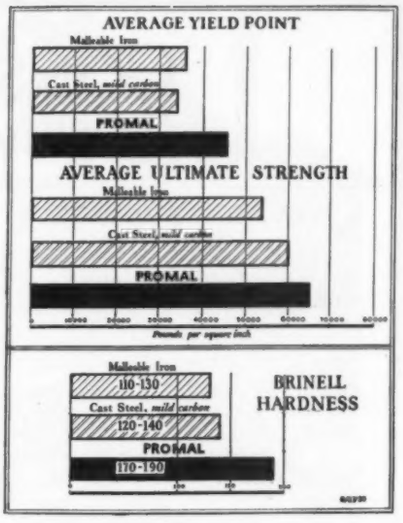
On July 1 the City of Bridgeport, Connecticut, inaugurated a new sanitary collection system using nine Colecto 10-cubic yard bodies mounted on Mack AB Chassis. They found the next day that they were able to reduce the crew of men used to handle all collection of garbage, ashes and rubbish from forty-two previously used, to thirty. They also determined that one Colecto body completed the work of approximately six trailers they had previously used, and they were able to do away with approximately forty horses. They accomplished this in spite of the fact that they now go to the back of the houses to pick up the material whereas, before, they were handling it by curb collection.

Sanitary District No. 1 of Hempstead, Long Island, also inaugurated its sanitary collection of garbage and refuse about the same time, using six Colecto 5-cubic yard bodies mounted upon Ford Chassis.

B. Nicoll & Co., N. Y., who furnished the equipment to these cities, supplied us with the above information.

Gravity Rear End Dump Wagon by Euclid

A late addition to the Euclid Crane & Hoist Company's line of earth moving equipment is the Gravity Rear End Dump Wagon. Built on the Euclid "Track-Wheel" Crawler-Type chassis, it has been found excellent for working in rock, sticky clay or gumbo. It is fast, has a capacity of six yards, and can be pulled easily by a 30 tractor under adverse conditions. This Euclid six-yard wagon is built in one size only to operate on shovel work. It is operated by the tractor driver, who by simply giving a slight pull upon a rope, releases a catch which permits the load to dump and the body rights itself automatically ready for reloading.

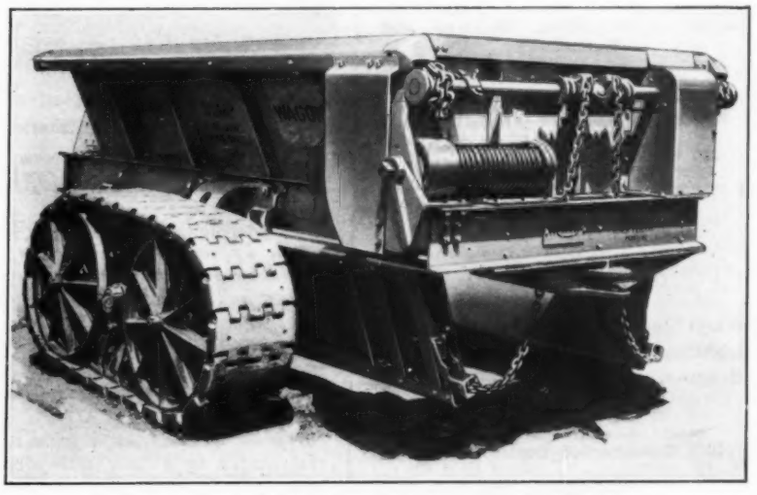


Promal Properties

Cast Iron Cut-In Connection for Sewers

The Atlas Mineral Products Co., Mertztown, Pa., has brought out a cast iron cut-in connection for use in connecting house services or branch lines to main sewers. In using this device, a hole of the proper size is cut in the sewer main at the proper angle, the spigot end of the fitting inserted, jute is then packed around the connection, and the joint is completed by finishing with concrete. The bead on the spigot end of the connection prevents jute or concrete from entering the sewer, while stops on the bell end prevent it from entering too far.

This cut-in connection is available in standard sizes.



Western Crawler Wagon With Spring Wind-Up

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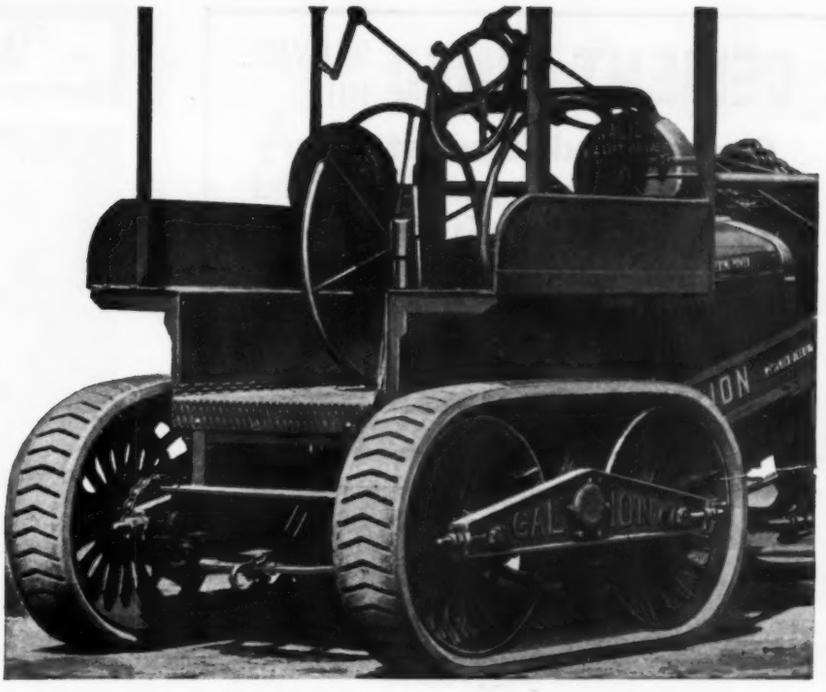
Sure-trac Rubber Crawler



A Feature of Galion E-Z Lift Motor Grader

Galion's recent development in Motor Grader construction, the Sure-Trac Rubber Crawler, eliminates entirely the objectionable features found in steel crawlers. For example, sand, which sets up a grinding action between the sprockets and steel plates of metal crawlers, causing great wear to both, has no effect upon the rubber crawlers — there are no links or sprocket teeth.

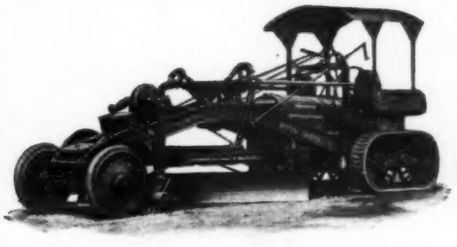
Galion Rubber Crawlers also provide:

GREATER TRACTION—greater flexibility of the continuous rubber track provides positive traction under all working conditions. Gripping action of rubber easily carries the crawler over large stones or rough soil.

GREATER OPERATING ECONOMY—a guarantee of 5000 miles of service, backed by the world's largest tire producer. A rubber crawler, after traveling over 17,000 miles in sand territory, showed little wear.

LESS VIBRATION — destructive vibration, caused by the flopping action of metal links or plates is replaced by the smooth, cushioned surface of the rubber track. Wear on tractor and grader parts is substantially reduced and real comfort is provided for the operator.

HIGHER SPEED—rubber track is designed and constructed to stand up under a much higher speed than any steel crawler ever designed.



A bulletin describing Galion Sure-Trac McCormick-Deering Graders will be sent on request.

The Galion Iron Works & Mfg. Co.

Galion . . . . Ohio

Galion Distributors

W. A. Adams Tractor & Equip. Co., Raleigh, N. C.
R. S. Armstrong & Bro. Co., Atlanta, Ga.
O. B. Avery Co., St. Louis, Mo.
Badger Tractor & Equip. Co., Milwaukee, Wis.
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Frankfort Equip. Co., Frankfort, Ky.
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Murphy & Murphy, Little Rock, Ark.
Northfield Iron Company, Northfield, Minn.
C. T. Patterson Co., Inc., New Orleans, La.
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Power Equip. & Service Co., New Haven, Conn.
F. Ronstadt Co., Tucson, Ariz.
Salina Tractor & Thresher Co., Salina, Kan.
Bert Smith, Enid, Okla.
Smith-Booth-Usher Co., Los Angeles, Cal.
Standard Road Equip. Co., Rockford, Ill.
W. H. Stoutenburg, Penn Yan, N. Y.
Tennessee Tractor Co., Nashville, Tenn.
F. E. Vaughn, LaCrosse, Kan.
Virginia Road Machy. Co., Richmond, Va.
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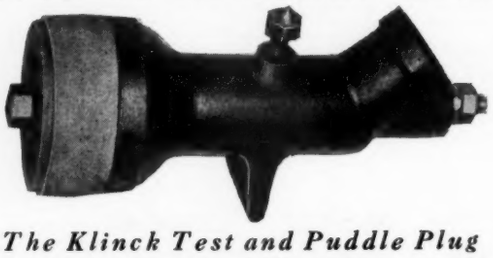

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With Our Authors

Harold S. Crocker, City Engineer of Brockton, Mass., received his education at Massachusetts Institute of Technology and the night school at Franklin Union, Boston. His first employment was in the City Engineer's office at Brockton, in 1911. He was employed as transitman, chief of party, and highway inspector, until April, 1916. He then resigned to open an office with R. P. Jackson, under the firm name of Jackson and Crocker. The partnership lasted three years. In the meantime, Mr. Crocker was elected City Engineer of Brockton, on January 1, 1917, and has held the position from that date to the present time. The major accomplishment during that time was the reconstruction of the sewerage system, at the cost of about $400,000, under his personal design. The pumping plant was changed from steam pumping engines to electrically driven centrifugal pumps, and to the sand filter beds, preliminary plain sedimentation and two acres of trickling filters were added.

Mr. Crocker is a trustee of the Brockton Savings Bank; a director and member of the security committee of the Security Cooperative Bank. He is assistant treasurer and a director of the Brockton Agricultural Society—the largest industrial fair in the east; president of the Commercial Club of Brockton; a Past Master of Baalis Sanford Lodge A. F. and A. M.; and member of the other Masonic bodies.

Mr. Crocker contributed the article on "Snow Removal at Brockton."

F. A. Liefrinck, who tells us of some of the water problems of Holland, recently visited this country on a tour of inspection, making trips to many of the most interesting water supply projects that he could find. He is an engineer of the Government Bureau of Water Supply at The Hague, Holland.

L. McLaren Hunter was born at Cambuskenneth near Stirling, Scotland, 1889, educated at Stirling High School, Stirling Technical and Glasgow Technical College. Apprenticed to Municipal Engineer, Stirling, for five years on general engineering works, two years Assistant Engineer in the same office on Filtration Plant (Slow Sand) water distribution; Sewage schemes, and Road work, also Town Planning —Assoc. Men. Inst. of Municipal and County Engineers (London). From 1911 he has been to date Assistant Engineer and latterly Roadway Engineer, City Engineer's Office, Ottawa, under A. F. Macallum, Commissioner of Works, in charge of pavements, sidewalks and special works. During this period there has been constructed sixty miles of pavements—(asphalt, stone and wood blocks)—and one hundred and twenty miles of concrete sidewalks. Mr. Hunter contributed the article on "Snow Cleaning in Ottawa."

E. W. Meckley received his engineering education at the Pennsylvania State College and was graduated in 1910 with the degree of B. S. in Sanitary Engineering. His first position was with the City of Allen-

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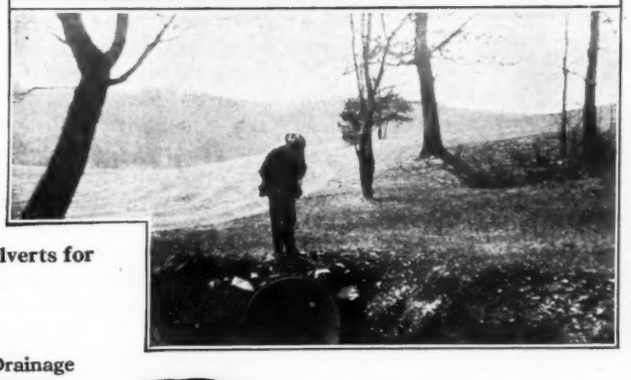

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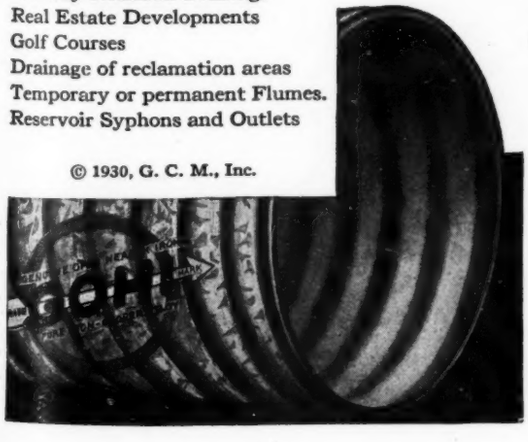

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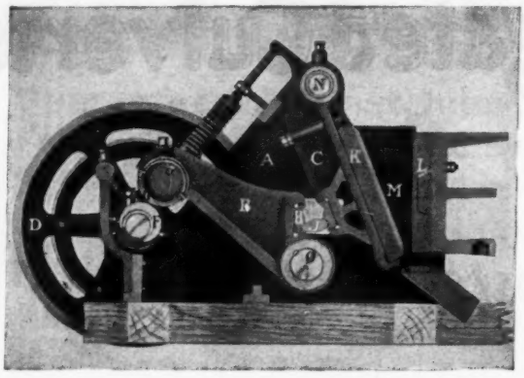

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town, Pa., as draftsman and assistant engineer and later as assistant City Engineer. He also worked a short time for the American Bridge Company and as Instructor in Civil Engineering at his Alma Mater. During the World War he served nearly a year in the Aviation Section of the Signal Corps. During the years 1920 to 1924 he was engaged with the City of Akron as Assistant Engineer on Sewer design. In 1924 he was appointed City Engineer of Allentown, Pa., which is his present position.

Mr. Meckley's article describes snow removal methods in Allentown.

Ernest W. Steel, after serving nearly two years with the Engineers during the War, returned to get his degree in Civil Engineering in 1920 from Cornell University. In 1919 he made some studies in municipal engineering at the University of Sheffield, England. Since graduation he has been engaged in public health engineering work for the International Health Board, State Health Department of Texas and city of Waco, Texas. For the past five years he has been professor of municipal and sanitary engineering and head of that department at the Agricultural and Mechanical College of Texas. He is director of the Sewage Research Laboratory of the Texas Engineering Experiment Station. During the two years the laboratory has been established bulletins and reports dealing with treatment of sewage and dairy wastes have been issued. In 1928 he was awarded by Cornell the Fuertes Graduate Medal for original research. He is co-author, with V. M. Ehlers, of a book, "Municipal and Rural Sanitation," which is used as a text by a number of colleges and universities. (Editor's Note: And it's an unusually fine book, too.) His article on "Industrial Waste Treatment" should also be of value.

E. Bender, who contributed the article describing the Barrington plant, one of New Jersey's modern activated sludge plants, has been associated with the Roberts Filter Manufacturing Company of Darby, Pa., for the past eleven years. He is assistant chief engineer, and has been in close contact with many water purification plants, sewage treatment plants and pumping stations located throughout the country. He is a designer of several unique devices used in conjunction with water and sewage plants and devotes much time in preparing plans for the economical uses of plant equipment. He is a graduate engineer, and served in the United States Navy during the World War. Another article by Mr. Bender on the design of pipe galleries for filtration plants will appear in an early issue.

A. G. Bruce, who has been perhaps our most popular contributor in the highway field, is a senior highway engineer of the Bureau of Public Roads. Lately he has been acting as chief of the Division of Design. His experience in the highway field has been wide, as is shown by the material covered in the article published herein.

A. E. Clark, concerning whom more data will appear next month (we hope), is associate director of the Bureau of Sanitary Engineering of the Tennessee State Department of Health. Mr. Clark is in charge of water supplies in that state. Some of the experience gained in treating the highly turbid waters of Tennessee is made available for others in Mr. Clark's excellent article beginning on Page 50.

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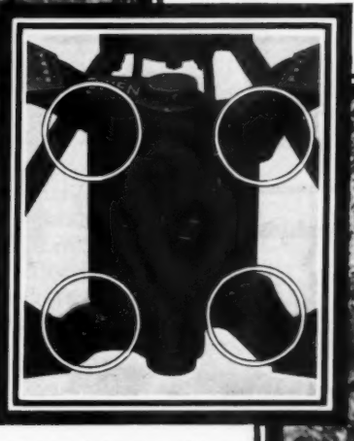

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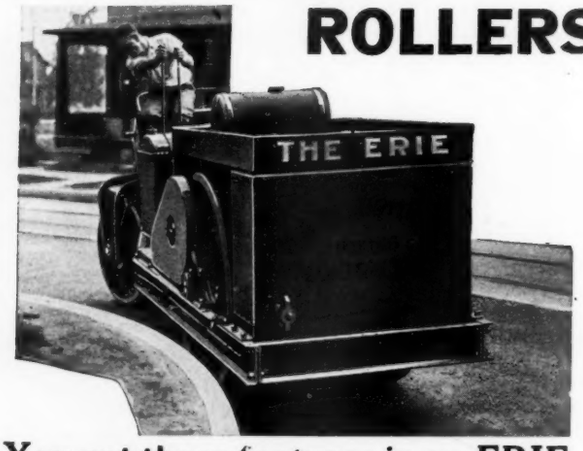

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The University of Michigan having recognized the need for a trained public service and provided the opportunity for such training F. R. Buechner enrolled in the Municipal Administration curriculum at Ann Arbor in 1917 and was graduated therefrom after completing the four year course. During the last year of academic training he was granted an assistantship in political science and was engaged in research studies in the University Bureau of Government.

For a short time after completing the academic work he was engaged in editing *The City Manager Bulletin* (now *Public Management Magazine*). Later he was employed on the staff of the Detroit Bureau of Governmental Research.

In 1923 he was appointed city manager of the City of Grand Ledge, Michigan. After a year of service the larger opportunity at Gladstone, Michigan (population 5,200), developed and he has served six consecutive years in that position.

Last February he was the winner of one of the two annual City Manager Traveling Fellowship Awards of the International City Managers Association for the purpose of conducting a research study in the field of government. The contest was opened to all active city managers and was decided on the timeliness of the subject proposed and the method of approach suggested. Mr. Buechner's subject was: Can the Municipality Afford to Carry Its Own Workmen's Compensation Where Permitted by Law? If So, What Is the Best Practice and the Best Method of Making the Transition From Private Contract Insurance to Self-Insurance? Several cities have ventured such self-insurance and the cities selected have been Staunton and Lynchburg, Virginia, and Grand Haven, Muskegon, and Highland Park, Michigan.

Trade Publications

Use Form on Page 101 to Secure Any of These

Aeromix.—A booklet issued by Vogt Bros. Mfg. Co., Louisville, Ky., describes a new system of aeration for water treatment. This contains much information of value to the sanitary engineer regarding a new type of aerator.

Construction Equipment.—The National Equipment Corporation, Milwaukee, Wisc., has just issued a pictorial catalogue describing briefly their line of equipment. This is illustrated with a set of excellent photographs showing the various pieces of equipment at work.

Water Meter Setting and Testing.—The Ford Meter Box Co., Wabash, Ind., has published a 56-page catalog devoted to meter setting and testing equipment. The matter of selection of settings is discussed and suggested meter settings are shown. The various Ford devices are shown.

Tarmac Construction.—Mixed-in-place construction with Tarmac, an illustrated booklet, has been published by American Tar Products Co., Pittsburgh, Pa. A copy will be sent free on request.

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Material Handling Machinery.—The Barber-Greene Co., Aurora, Ill., has just issued a 32-page catalog illustrating their complete line of material handling equipment, from pipe line ditching to pouring concrete for building purposes. A page of the catalog is devoted to each machine. There are described and illustrated six different kinds of conveyors for handling sand, for central mixing plants, for industrial work, for pouring wet concrete into forms and for bulk jobs, the Belt Feeder and the Shuttle Conveyor. Also four types of bucket loaders; four different vertical boom ditchers, all crawler mounted, and for all kinds of work. Six different machines for coal handling are described, and the Barber-Greene snow loader and the trailer for transporting Barber-Greene machines.

Koehring Paver.—The Koehring 27-E paver is fully described in a 48-page catalog just issued by the National Equipment Corp., Milwaukee, Wisc. In addition to a full description of the 27-E paver, and its component parts, there is in this booklet a lot of valuable information for the paver operator and the contractor. Rapid output is important for the constructor. Some elements of it are covered in this.

Sewage Purification.—Ames Crosta Mills & Co., Ltd., Nottingham, England, have issued a 126-page catalog describing their sewage disposal apparatus. The American agent for this equipment is the Simplex Ejector and Aerator Corp., Chicago, Ill. This complete catalog illustrates a large number of English plants and gives some details of design.

Swimming Pools.—An illustrated 32-page booklet. The illustrations and text show that it is a comparatively simple matter to construct attractive and serviceable pools both indoors and outdoors. Various designs for pool construction are pictured and those interested in construction features will find the specifications for concrete particularly helpful. Factors influencing the selection of site, determination of size and shape, as well as the general arrangement of pool facilities are given detailed attention. Text devoted to ways of controlling condensation and a brief discussion of the acoustical treatment of the walls and ceilings of indoor pools add further to the booklet's practical value. Underwater and overhead lighting, pool sanitation, and the different methods of filtration and sterilization are outlined. Copies of "Swimming Pools" may be obtained without cost from the Portland Cement Association, 33 West Grand Avenue, Chicago.

Sewage and Water Treatment.—The Dorr Co., 247 Park Ave., New York, has published the second series of "Modern Water and Sewage Treatment Plants." This booklet illustrates with excellent photographs and gives brief information concerning 35 modern water and sewage plants. It should be of interest and real value to all engineers engaged in sanitary work.

Road, Pit and Quarry Equipment.—The Wisconsin Foundry and Machine Co., Madison, Wisc., have issued a 40-page catalog describing their line of "Badger" road construction equipment. It describes portable sand and gravel bins, plants, screens, conveying systems, portable conveyors, road oilers, crushers, hoists, drag scraper buckets, air compressors, drills and other equipment.